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Fatal Accidents in Coal Mines of North America

About 2800 Killed During 1908 and 20,000 in Last Decade; Fatality Rate Increasing; Accidents Are More Numerous under Liability Act

BY FREDERICK L. HOFFMAN*

Accidents to workmen are no longer a neglected subject in law or economics, but in every civilized country of the world workmen's compensation and accident prevention are in the front of public discussions as problems which demand a more successful solution than has heretofore been the case. The passage in 1906 of the English Workmen's Compensation Act has crystallized American opinion more, perhaps, than any other measure, and in some of the most important States the whole question of employers' liability is under serious consideration. The English act has the advantage of precision in terms, and under it a definite money value is assigned to human life, with the certainty of compensation to dependent survivors in the following terms:

"(1) If the workman leaves any dependants wholly dependent upon his earnings, a sum equal to his earnings in the employment of the same employer during the three years next preceding the injury, or the sum of one hundred and fifty pounds, whichever of those sums is the larger, but not exceeding in any case three hundred pounds, provided that the amount of any weekly payments made under this act, and any lump sum paid in redemption thereof, shall be deducted from such sum, and if the period of the workman's employment by the said employer has been less than the said three years, then the amount of his earnings during the said three years shall be deemed to be one hundred and fifty-six times his average weekly earnings during the period of his actual employment under the said employer.

"(2) If the workman does not leave any such dependants, but leaves any dependants in part dependent upon his earnings, such sum, not exceeding in any case the amount payable under the foregoing provisions, as may be agreed upon, or, in default of agreement, may be determined, on arbitration under this act, to be reasonable and proportionate to the injury to the said dependants."

In practice the amounts actually secured as compensation in the event of death vary, but the degree of variation is of small importance. Where the cases have been settled in the county courts the average amount recovered in 1907 has been £174 9s. ($847.80), while the settlements under agreement and informal arbitrations return an average amount of £173 6s. 5d. ($842.32). There are exceptions to be taken under the common law, but such cases are rare and not of practical importance.

It is apparent from the experience which has been had since the act of 1906 went into effect that the average compensation paid in the event of the death of a workman due to an accident in the course of his employment is about £175 ($850.50). If allowance is made for the higher average rate of wages prevailing in this country a corresponding act would probably call for an average payment of $1500, or three years' payment at $500 each.

Since during 1908 there occurred in the coalfields of North America 2686 officially recorded fatal accidents, the compensation which would have had to be paid on the basis of $1500, payable in the case of each death, would have been in the aggregate not less than $4,029,000. Actually, however, the amount would probably have been much more since a number of deaths resulting from coal-mining operations are not officially recorded as such because of defective methods in some of the States, while deaths directly due to mining casualties, but not immediately resulting therefrom, are, in the nature of the case, excluded from the official reports as fatal occurrences at the time when the reports are made. Under any rational system of workmen's compensation, however, all such cases would have to be compensated for, and the total amounts, therefore, would be quite considerably in excess of the estimated amount on the number of deaths officially returned as resulting from coal-mining casualties in the different States.

There is the further probability that the minimum of $1500 would not be considered a sufficient equivalent for the loss incurred, and it would be more likely that the average amount of compensation to be paid would be fixed as five years' average earnings, which would probably not be less than $400, making allowance for time lost, or in the aggregate not less than $2000, instead of the first estimate of $1500. So that under any general system of workmen's compensation throughout the coal-mining States, based on the principles of the English act of 1906, the average amount of compensation in the event of death would probably be not less than $1500 nor more than $2000, and the average total amounts to be paid by coal-mining companies on this account alone, and without reference to compensation for injuries, would probably not be less, on the

TABLE 1. NUMBER OF PERSONS KILLED BY ACCIDENTS IN COAL MINES OF NORTH AMERICA. 1899–1908.

States, Territories and Provinces.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1899-1908.
Alabama	40	37	41	50	57	84	185	96	154	110	854
Colorado	41	29	55	73	40	89	59	88	99	61	634
Illinois *c*	84	94	99	99	156	157	199	155	165	175	1,383
Indiana	16	18	24	24	55	34	47	31	53	45	347
Indian Territory	25	40	44	60	33	30	44	39	32	44	391
Iowa *c*	20	29	26	55	21	31	24	37	35	38	316
Kansas	16	22	26	27	36	16*b*	36	30	32	*a*	241
Kentucky	7	17	21	19	25	19	31	39	32	40	250
Maryland	5	7	12	11	13	12	13	7	*a*	12	92
Michigan	4*b*	10	6	6	8	7	8	6	7	6	68
Missouri	14	10	15	10	17	11	11	16	8	10	122
New Mexico *c*	15	15	9	17	17	15	5	9	31	34	167
Ohio	57	68	72	81	114	118	131	127	153	112	1,033
Pennsylvania (Anth.)	461	411	513	300	518	595	644	557	708	678	5,385
Pennsylvania (Bit.)	258	265	301	456	402	536	479	477	806	572	4,552
Tennessee	20	10	53	226	26	28	29	33	31	34	490
Utah	0	209	10	8	7	9	7	7	8	8	273
Washington	45	33	27	34	25	31	13	13	36	25	282
West Virginia *c*	89	141	134	120	159	140	194	268	356	625	2,226
British Columbia	11	17	102	139	42	37	12	15	31	18	424
Nova Scotia	19	21	14	19	31	19	20	28	35	39	245
Total deaths	1,247	1,503	1,604	1,834	1,802	2,018	2,191	2,078	2,812	2,686	19,775

a Returns not available. *b* Six months only. *c* Year ended June 30, 1908.

*Statistician, Prudential Insurance Company of America, Newark, N. J.

basis of 3000 fatal injuries per annum, than $4,500,000, and not more than $6,000,000.

Insurance Increases Accidents

It is more difficult to estimate what would be the cost of compensation for injuries since the term injury itself is difficult of exact definition. Under the English law no compensation is paid if the injury results in the loss of less than two weeks' earning capacity, but since the law has been in operation the number of injuries of more than two weeks' duration has very considerably increased. In fact, the tendency of all workmen's compensation laws is to increase the number of minor injuries which, under ordinary circumstances, would not be the cause of incapacity to work or require financial relief.

The most trustworthy of our coal-mining statistics do not show a rate in cases of nonfatal accidents in excess of 10 per cent., but under the earlier operations of the Illinois inspection laws the recorded rate has been as high as 16 per 1000 in 1899; the rate has, however, fallen continuously until in 1906 it was only 7.7 per 1000 employed.

The average recorded nonfatal accident rate for the anthracite coalfields of Pennsylvania is 6.93 per 1000 for the five years ending with 1906, while for the bituminous fields for the same period the rate was 6.48 per 1000. In England the recorded rate of nonfatal accidents for 1907 was only 6.26 per 1000, but it is officially stated that "the number reported is only a small fraction of the number of nonfatal accidents that actually occur," and this statement is supported by the statistics for the Northumberland mines, which in 1907 gave a rate of 68.1 per 1000 of two weeks' duration or more, while in the Durham coalfields the rate was 88.9 per 1000. The rate would be materially increased, certainly by as much as 50 per cent., if allowance were made for accidents of less than two weeks' duration.

According to English statistics for 1908 the rate of disablement cases in proportion to the number employed in mines was 131.34 per 1000, while the fatal-accident rate in mining during the same year was 1.24 per 1000. The corresponding fatal-accident rate for American coal mines for the same year was 3.96 per 1000, so that without reference to nonfatal accidents the number of fatal cases which would require compensation under a similar law in this country would be about three times as large. The average compensation paid in fatal cases in England was $846.13, and the average compensation paid in disablement cases was $21.28. The average compensation paid in fatal cases practically corresponds to the previous estimate in the consideration of fatal cases, estimated on an American basis to require not less than $4,500,000, and not more than $6,000,000 per annum.

The average compensation in nonfatal cases under the English law ($21.28 per case), would unquestionably be materially increased under a similar law in the United States, and probably amount to not less than $30 per case. Since the proportionate number of disablement cases is also much larger in this country, and certainly not less than 150 per 1000 employees, the actual number of such cases per annum which would be required to be compensated for would be approximately 105,000. At an average cost of $30 for every case of disablement this would require annually not less than $3,150,000 to be paid in compensation on this account. If this sum is added to the minimum of $4,500,000 payable in compensation on account of fatal cases, the approximate total workmen's compensation in coal-mining operations in North America would be not less than $7,650,000 for both classes of applicants.

In English experience the average amount paid in compensation has been equivalent to about ½d. per ton of coal raised. This would be approximately one cent in American money, but since the unit cost of compensation in this country would probably not be less than one per cent. greater, the approximate cost would be about 1½c. per ton of the annual production of the coalfields of North America. In round numbers the annual production is about 500,000,000 tons which, on a basis of 1½c. per ton for the purpose of workmen's compensation, would require the disbursement of about $7,500,000 annually.

The foregoing considerations are prompted by the various proposals which have been made for accident insurance of coal miners, particularly in the report of the State mine inspector of Indiana, who, according to the Journal of Dec. 5, 1908, had prepared a bill providing for a pension fund for the benefit of disabled miners, the plan being to assess a tax of a certain number of mills on each ton of

TABLE 2. FATAL ACCIDENTS IN COAL MINES OF NORTH AMERICA, 1899-1908.
Ratio of Persons Killed per 1000 Employed.

States, Territories and Provinces.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1899-1908.
Alabama	3.10	2.59	2.90	2.79	2.94	4.71	10.74	5.23	7.61	5.86	4.99
Colorado	5.60	3.99	6.88	8.11	3.89	8.26	4.96	7.32	7.67	4.25	6.11
Illinois *c*	2.27	2.39	2.24	2.15	3.13	2.87	3.36	2.49	2.47	3.59	2.72
Indiana	2.07	1.82	1.98	1.83	3.64	2.70	2.53	1.61	2.79	2.36	2.37
Indian Territory	6.24	7.59	8.35	9.62	5.42	3.63	5.76	4.81	4.15	3.02	5.35
Iowa *c*	2.49	2.22	1.97	4.23	1.59	1.90	1.36	2.20	2.05	2.20	2.17
Kansas	1.57	2.06	2.28	2.70	3.61	3.09*b*	2.97	2.95	2.67	*a*	2.60
Kentucky	0.83	2.06	2.14	1.58	1.85	1.37	2.06	2.33	1.82	2.15	1.87
Maryland	1.08	1.32	2.23	1.99	2.29	2.11	2.09	1.13	*a*	2.00	1.82
Michigan	4.88*b*	6.11	3.26	4.24	2.54	2.58	2.93	2.83	2.43	1.94	2.91
Missouri	1.80	1.31	1.63	1.09	1.85	1.47	1.06	1.65	0.73	1.06	1.39
New Mexico *c*	7.98	7.44	4.81	10.11	7.26	7.61	2.35	3.82	10.13	9.26	7.27
Ohio	2.03	2.14	2.15	2.16	2.75	2.57	2.96	2.73	3.20	2.23	2.54
Pennsylvania (Anth.)	3.28	2.86	3.47	2.03	3.41	3.69	3.83	3.35	4.19	3.89	3.43
Pennsylvania (Bit.)	2.82	2.43	2.56	3.37	2.65	3.44	2.90	2.76	4.40	3.15	3.11
Tennessee	2.60	1.15	6.10	25.80	2.69	2.81	2.38	3.07	2.79	3.06	4.97
Utah	....	138.96	5.81	3.24	3.21	4.06	5.14	3.69	3.07	2.99	13.82
Washington	13.60	7.79	5.59	7.83	5.13	6.69	2.73	2.52	6.04	4.68	5.94
West Virginia *c*	3.55	5.03	4.14	3.78	4.03	3.08	4.24	4.98	6.92	10.35	5.38
British Columbia	2.91	4.22	25.67	34.65	9.85	8.31	2.72	3.12	5.12	2.95	9.24
Nova Scotia	3.39	3.17	1.83	2.36	2.79	1.63	1.86	2.31	2.89	3.02	2.48
Average	2.98	3.25	3.24	3.49	3.14	3.37	3.44	3.16	4.17	3.96	3.46

a Returns not available. *b* Six months only. *c* Year ended June 30, 1908.

TABLE 3. FATAL ACCIDENTS IN COAL MINES OF NORTH AMERICA. COMPARISON OF 1908 WITH THE FIVE PREVIOUS YEARS.

States, Territories and Provinces.	Number Persons Killed, Yearly Average. 1903-07.	Number Persons Killed, Yearly Average. 1908.	Rate per 1,000 Employed. 1903-07.	Rate per 1,000 Employed. 1908.	Rate of Increase or Decrease per 1000 Employed.
Alabama	115	110	6.19	5.86	−0.33
Colorado	75	61	6.48	4.25	−2.23
Illinois *c*	167	175	2.84	3.59	+0.75
Indiana	44	45	2.60	2.36	−0.24
Indian Territory	36	44	4.71	3.02	−1.69
Iowa *c*	30	38	1.83	2.20	+0.37
Kansas	33*a*	*d*	2.97*a*	*d*	....
Kentucky	29	40	1.90	2.15	+0.25
Maryland	11*b*	12	1.89*b*	2.00	+0.11
Michigan	7	6	2.47	1.94	−0.53
Missouri	12*a*	10	1.40*a*	1.06	−0.34
New Mexico *c*	15	34	6.49	9.26	+2.77
Ohio	129	112	2.85	2.23	−0.62
Pennsylvania (Anth.)	604	678	3.70	3.89	+0.19
Pennsylvania (Bit.)	540	572	3.26	3.15	−0.11
Tennessee	29	34	2.74	3.06	+0.32
Utah	8	8	3.70	2.99	−0.71
Washington	24	25	4.65	4.68	+0.03
West Virginia *c*	223	625	4.73	10.35	+5.62
British Columbia	27	18	5.71	2.95	−2.76
Nova Scotia	27	39	2.30	3.02	+0.72
Average	2,180	2,686	3.47	3.96	+0.49

a 4½ years only. *b* 4 years only. *c* Statistics for year ended June 30, 1908. *d* Not available.

coal produced, plus a small percentage tax on wages earned by employees. The money, according to this plan, is to be paid into the State treasury and distributed to those entitled to a benefit in sums proportionate to the extent of injury. The proposed law provides that in each case the benefits shall be paid without question as to contributory negligence of the employee killed or injured.

A similar law went into effect in Montana, as Chapter 67 of the Session Laws of 1909, creating an accident-insurance fund to cover workmen employed in coal mining. Under this law employers are required to deduct 1 per cent. of the wages paid monthly, and pay the sum so deducted to the State auditor. They are also required to pay to the auditor monthly one cent for each ton of coal mined and shipped or sold locally. The insurance is thus compulsory upon both workmen and employers. How far the law has been successful in actual operation is at this time not known. A somewhat similar act passed by the legislature of the State of Maryland some years ago was declared unconstitutional.

TABLE 4. TWENTY-YEAR RECORD OF FATAL ACCIDENTS IN COAL MINES OF NORTH AMERICA, 1889-1908.

Year.	Number of Employees.	Fatal Accidents.	Rate per 1000 Employed.
1889	262,223	660	2.52
1890	288,205	701	2.43
1891	325,840	1,076	3.30
1892	342,744	859	2.51
1893	382,133	965	2.53
1894	385,579	957	2.48
1895	395,549	1,057	2.67
1896	401,874	1,120	2.79
1897	405,433	947	2.34
1898	405,600	1,049	2.59
1899	417,415	1,247	2.98
1900	462,308	1,503	3.25
1901	494,367	1,604	3.24
1902	525,443	1,834	3.49
1903	574,210	1,802	3.14
1904	598,856	2,018	3.37
1905	637,522	2,191	3.44
1906	658,189	2,078	3.16
1907	673,657	2,812	4.17
1908	678,785	2,686	3.96
1889-1893	1,601,145	4,261	2.66
1894-1898	1,994,035	5,130	2.57
1899-1903	2,473,743	7,990	3.23
1904-1908	3,247,009	11,785	3.63
1889-1908	9,315,932	29,166	3.13

Cost of Insurance Nearly Doubled in England

In English experience under the new act the cost of employers' liability insurance to protect employers against the risk to the industry resulting from the law has nearly doubled. Incapacity, under the present act, has a money value, which encourages malingering and imposition on the fund. Even under the present act from 20 to 25 per cent. of the injuries are trivial and do not come within the scope of the law. In the opinion of Sir Thomas Oliver, there is under the present act a decided inducement for many workmen to exaggerate slight injuries and to profess disablement for a fortnight.

This same authority, whose home is in the heart of the English coal-mining district, states that in the case of one large coal owners' association the cost of the act is equivalent to 0.568d. per ton of coal raised, and as the number of tons raised in 1907 by this association was 38,721,790, the act cost the association £91,707 ($445,696), or roughly, 19s. per £100 of wages. This is compared with 0.243d. per ton, or 9s. 3d. per £100 of wages paid in 1900, when the total output of coal was 33,206,246 tons, and the total cost of compensation £33,620 ($163,393).

These illustrations clearly emphasize the importance of the whole subject of workmen's compensation to the coal-mine owners of North America, and the corresponding importance of the degree of accident frequency in the different coalfields, the tendency of the rate from year to year, and the correspondingly important question of successful accident prevention.

During 1908, out of an average of 678,785 persons employed in the coal mines of North America, 2686 were killed by accident, or at the rate of 3.96 per 1000. This is the highest rate on record for any single year during the last two decades except the previous year, when the rate was 4.17. The statistical tabulation for 1908 is unfortunately not quite complete, and does not include the State of Kansas, for which information could not be secured. It also does not include the State of Arkansas, nor Alaska, but the coalfields of both are of very limited extent.

It is difficult to understand why information of this kind should not be made public at the earliest possible date, and why mine inspectors should withhold the data from publication for practically more than a year after the date of occurrence. Where so small a number of items requires consideration it would seem that a complete return should be available within less than 30 days after the close of the calendar year, and it is to be hoped that a mandatory provision to this effect will be included in the mining laws of all the States which are now derelict in publishing mining accidents in the proper manner and at the proper time.

Table 1 exhibits in detail for States, Territories and Provinces, the number of persons killed by accident in the coal mines of North America during the ten-year period ending with 1908, except as otherwise stated on account of the impossibility of securing the necessary information. The table is complete for all of the States included in the tabulation except Kansas. For Illinois, Iowa, New Mexico and West Virginia the returns are for the year ended June 30. If allowance is made for the States for which information is not at present available, and for the imperfect returns of some of the States, it is quite probable that during 1908 the number of persons killed in American coal mines was not less than 2800. During the 11-year period ending with 1908 the total number of recorded deaths in American coal mines was 19,775, while the actual number was over twenty thousand.

Upward Tendency of Fatality Rate

Table 2 shows the fatality rate in coal mining in the United States and Canada, calculated upon the usual basis of the number employed. The fatal accident rate for 1908 for the entire coalfields of North America was 3.96 per 1000, against an average of 3.46 for the whole decade. While there has been a slight decline in the rate during 1908, the tendency of the rate itself is decidedly upward, and the most recent experience, in the great calamity at Cherry Hill, Ill., emphasizes the accuracy of this conclusion. During 1908 the fatality rate was above the average for the 10-year period in Alabama, Colorado, Illinois, New Mexico, Pennsylvania (anthracite), Washington, and West Virginia. The highest rate during the year prevailed in West Virginia, where it attained to 10.35 per 1000, a rate which, with the exception of one disastrous year in Utah, and two equally disastrous years in British Columbia, never has been equaled during the history of American coal mining in the last decade.

Table 3 exhibits the fatal accidents in coal mining in 1908, compared with the average for the preceding five years, both upon the basis of actual numbers and the rate per 1000 employed. The States showing an increase in the rate during the preceding five years are Illinois, Iowa, Kentucky, Maryland, New Mexico, Pennsylvania (anthracite), Tennessee, Washington, West Virginia and Nova Scotia. The increase in the average rate was 0.49 per 1000. As measured by this comparison the most favorable rate was experienced in the State of Missouri where the fatality rate was only 1.06 per 1000 during 1908, and 1.40 during the five years ending with 1907. The next lowest rate was experienced in the State of Michigan, followed by Maryland. All the other States have experienced average rates during 1908 of more than 2 per 1000 per annum.

Table 4 affords a means of convenient comparison of the fatality rate in coal mining during 1908 with those of previous years, showing the number of employees, the number of persons killed and the rate per thousand employed for each of the 20 years, 1889-1908. The table has also been arranged in four equal periods of five years each, and it is shown that the fatality rate has increased from 2.66 per 1000 during the first five years to 3.56 during the last, or, in other words, the actual excess in the rate at the present time is about 1 per 1000 employed over the normal rate of former years.

As emphasized in former summaries, the data confirm the conclusion that the tendency in the fatality rate of American coal mining is in the wrong direction.

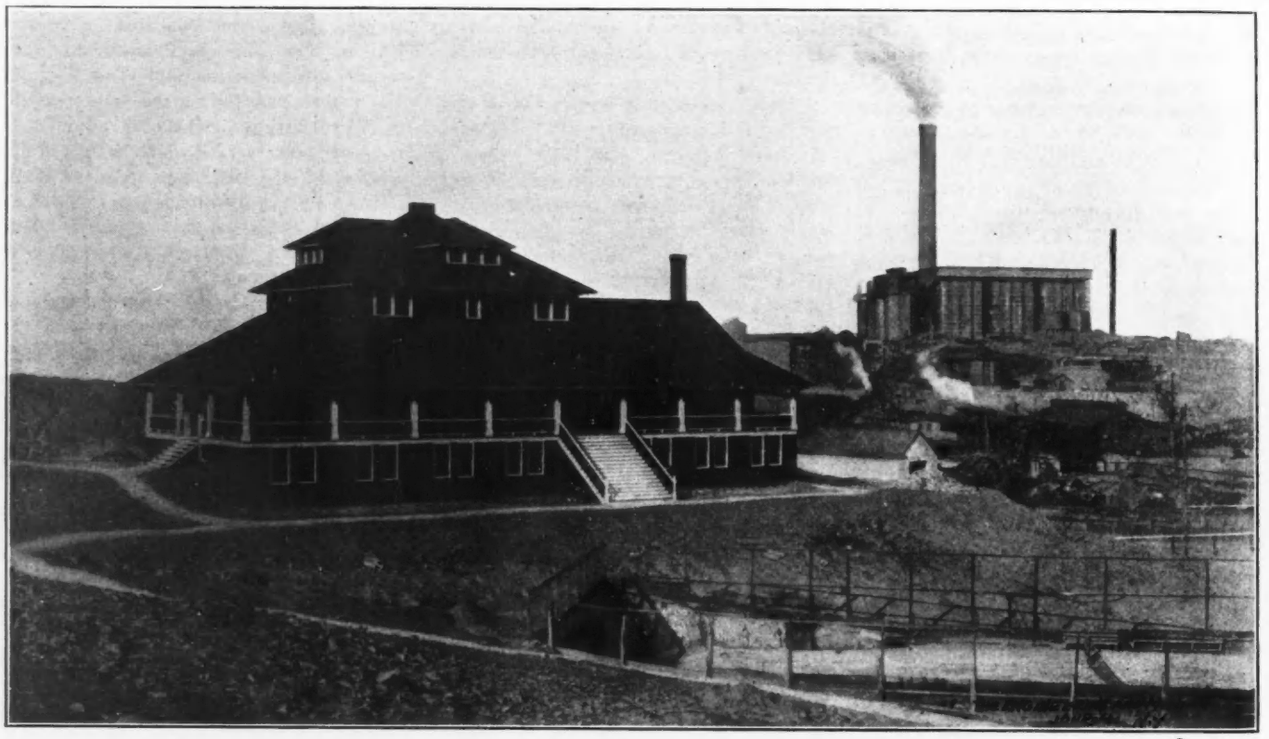
When the accident rate is compared with the rates of European countries, our coalfields are decidedly more dangerous and the loss of life is considerably higher. The subject itself demands more qualified attention than has heretofore been given to it, and much remains undone which could be done, and ought to be done, to mitigate the loss of life and the frequency of serious injury resulting from coal-mining operations. Especially should attention be directed to the resulting economic consequences to the vast population made more or less dependent upon the disasters which now occur with increasing frequency.

There is need in this country for an expert investigation into the whole subject in conformity to the thorough inquiry which has been made by the British Royal Commission of Mines, and which has been published in a series of practical reports. These reports, in six large volumes, constitute an extremely valuable source of information which, however, requires to be interpreted in the light of American coal-mining experience.

Of particular value is the appendix to the first report, prepared by A. E. Boycott, M.D., of the Lister Institute of Preventive Medicine, on breathing apparatus for use in mines. The reports cover every subject from the sanitary condition of the mine to timbering and safety lamps. Of equal importance in this conection are the decidedly practical rules and regulations for the prevention of accidents in Austrian mines, published in three volumes by authority of the Austrian government. Considering the vast financial aspects of possible drastic compensation laws as applied to coal-mining operation, the prevention of every possible accident becomes not only a matter of imperative duty, but also of financial importance to every coal-mining company of North America.

The Cowanee Club, Copperhill, Tennessee

Throughout the country, mining companies are realizing the importance of keeping their employees satisfied with their conditions. This is evident in the provision of modern dry houses at many mines, the improvement in the living quarters provided working men, and finally in the interest taken by some companies in the social welfare of their employees. There can be no doubt but that this is an important consideration in the success of any company, and especially of one operating in such a place as the average mining camp.



THE COWANEE CLUB AT COPPERHILL, TENN. SMELTING AND ACID PLANT IN BACKGROUND

At Copperhill, Tenn., the home of the Tennessee Copper Company, a club house modern and comfortable in every particular has recently been completed and occupied. Outside of the architectural features of the new club house, a photograph and plan of which accompany this article, the history and description of the Cowanee Club present some novel and interesting features.

History and Work of the Club

The Cowanee Club was organized about six years ago among the members of the engineering staff of the Tennessee Copper Company for the purpose of taking care of the social functions of the camp. For a while a room was kept in the Blue Goose, the company's boarding house; club quarters were also maintained in the basement of the company office building. A piano and pool tables were bought by the club, and through its efforts two tennis courts were graded and equipped, trap-shooting grounds fixed up, and a canoe club organized and maintained as an adjunct to the club.

The sentiment in favor of having a home for the club gradually took root and finally culminated in the securing of financial aid from the Tennessee Copper Company for the erection of the present club house. It was largely through the efforts of B. B. Gottsberger, formerly general manager at Copperhill, N. H. Emmons, acting general manager; P. H. Hubbard, mechanical engineer, and other prominent members of the staff of the Tennessee Copper Company, that the contribution of $10,000 was secured. This sum, together with about $2000 raised by the club members, was used for building and equipping the club house. The plans for the club house were drawn, with a little outside assistance, in the office of the Tennessee company at Copperhill, under the direction of Mr. Hubbard, from whom the accompanying plans and data were obtained.

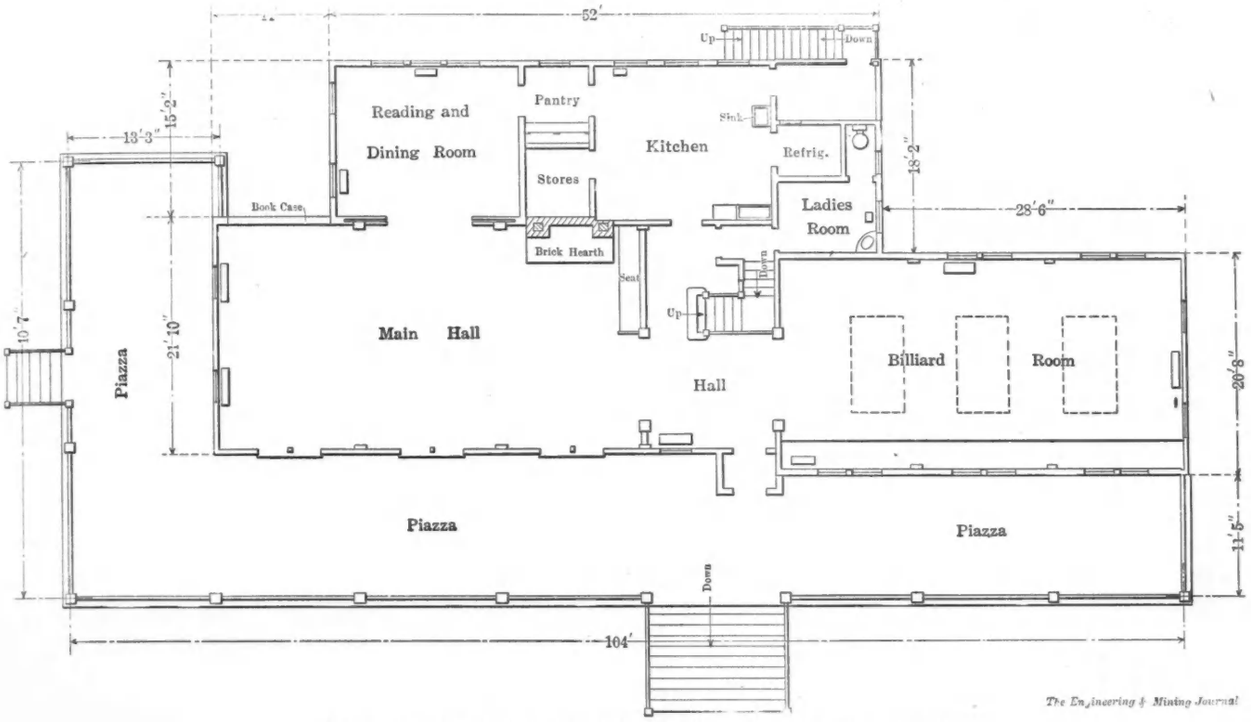
The Club House

The club house is situated near the foot of the hill, upon which are the homes of

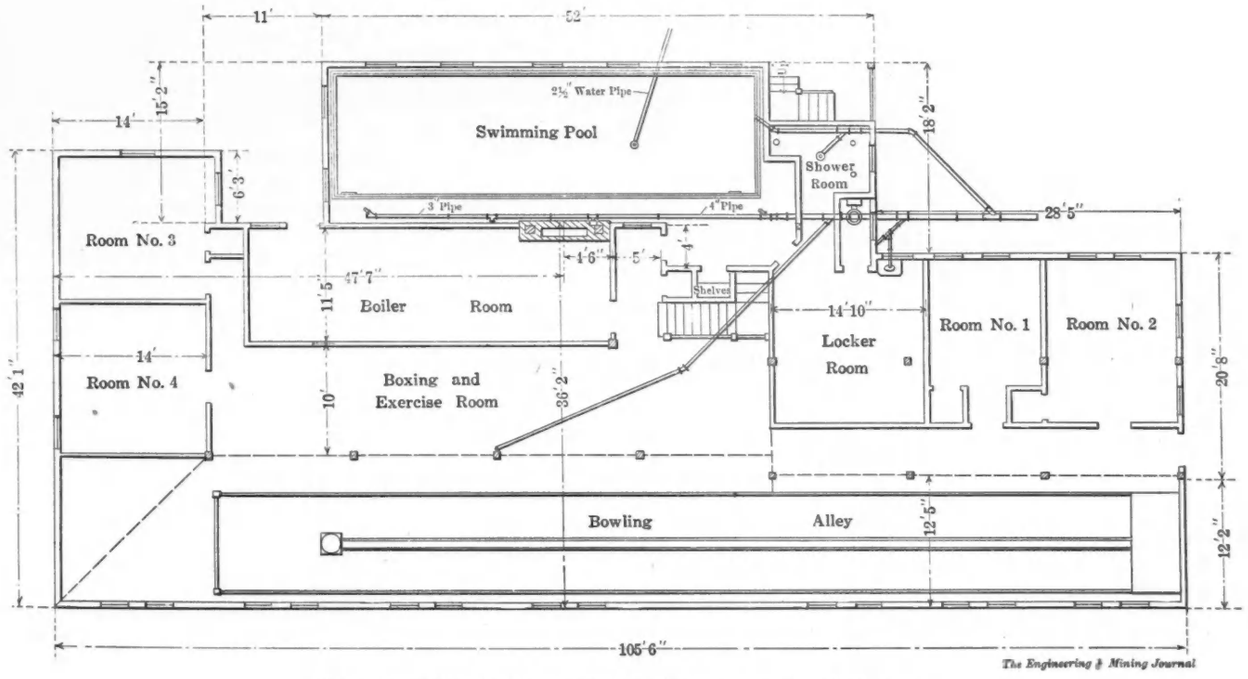
the members of the engineering force. It faces away from the smeltery, toward the company houses, and at the foot of the hill below the house are the tennis courts belonging to the club. The club building is a two-story and basement structure, with shingle exterior, and with a wide veranda around three sides. Upon entering the main floor from the front, there is a large billiard room at the right. The main hall opens to the left and is used for dances and receptions. Both the main hall and dining room are provided with a maple floor. The dining room is entered from the main hall and from it the kitchen, pantry, etc., are reached. Opposite the entrance is a stairway leading to the second floor, where are four bedrooms, arranged in pairs, with a connecting passage leading to a bathroom. Ample closets, shelves and a linen closet have been provided.

In the basement, which is finished in cement throughout, are the bowling alley, swimming pool and gymnasium. Here too are locker rooms, shower baths and toilets. Four rooms are also finished and floored.

As mentioned, bedrooms and kitchen are included in the design of the club



PLAN SHOWING ARRANGEMENT OF MAIN FLOOR OF COWANEE CLUB



PLAN SHOWING ARRANGEMENT OF BASEMENT OF COWANEE CLUB

house. These, however, are used only on occasions, such as the visits of the officers or directors of the company. The bedrooms are well furnished and comfortable in every particular. The culinary department, too, is well equipped and ready for immediate use at any time.

Heating System

A complete heating system is provided for the club house. There is a boiler room in the basement but ordinarily steam for the heating system is taken from the power plant at the smeltery and is also used to heat water for showers, etc., being run through coils in the two 300-gal. tanks provided to store water for such purposes. The exhaust steam and condensed water from the heating plant are run into the swimming pool and are sufficient to heat the water to a comfortable degree for swimming during the winter.

Management of the Club

The club is still run as a private organization, membership not even being restricted to company employees. As in city clubs, provision is made for out-of-town members as well as for resident ones. Already from the popularity of the club there can be no doubt as to its success. It is considered a common rendezvous and each evening there is sure to be a crowd at the pool tables and bowling alleys. The club is open to members and their wives at all times, and at frequent intervals dances are held in the club house.

It is interesting to know that J. V. Bohn, superintendent of mines for the Tennessee Copper Company, is urging the building of a club house at Ducktown, which is the headquarters for the company's mines, and about five miles from Copperhill. It is planned to have this club run by the Young Men's Christian Association and to have its membership open to all company employees. It will be supported and run as other Y. M. C. A. organizations. A tennis court has already been completed at the Burra Burra mine for the use of members of the engineer corps and a staff house is being erected.

A movement is on foot to establish a register for youths by which vacancies for junior clerks in the mine offices of the Witwatersrand can be offered to lads with a secondary education of recognized standard. The subcommittee of the Transvaal Chamber of Mines has reported that it is desirable to open such register of youths of good character who have given promise in their scholastic careers of ability in commercial subjects, and has recommended that the Association of Mine Managers be requested to keep the register, which it has consented to do.

Iron Ore Deposits of Brazil*

By Orville A. Derby*

The existence of iron-ore deposits in Brazil has been known for over two centuries, and these deposits have been worked in a limited way. It is reasonably probable that the first iron produced on the American continents came from Brazil. Unfavorable conditions exist, but for the present it is sufficient to say that a deficiency of ore of excellent quality, and in good working conditions as regards mining, is not one of them.

Iron ores are known in every state of Brazil and specimens figure in every national exposition. Definite information regarding most of the deposits is lacking. The greater part of the specimens exhibited in expositions and museums are magnetites, and of these the majority have proved to be quite highly titaniferous. A good number of specimens of excellent hematites representing numerous widely separated localities, have also appeared.

The districts regarding which definite information is at hand are those belonging to the states of Mines Geræs, São Paulo, Bahia, Goyaz, Paraná, Santa Catharina, Rio Grande do Sul and Matto Grosso. The ores known in the first three and the last of these states are predominantly hematites; in the others, magnetites.

With a single exception none of these districts have been studied in a way to give definite information on the subject of iron-ore supply. The district that has been investigated is situated in the eastern central part of Mines Geræs, in the section of the Espinhaço range that forms the divide between the Rio Doco and the São Francisco drainage systems extending over about two degrees of latitude with a width of about one degree of longitude. This is also the most productive of the goldfields of Brazil, and in consequence is one of the oldest and most densely populated of the interior regions of the country. Notwithstanding this fact, however, it has only been very imperfectly mapped and there is a singular lack of reliable and accurate information regarding its geological and economic features. This lack is now being supplied by a small party of the Serviço Geologico e Mineralogico do Brazil, under the direction of Dr. Luiz Felippe Gonzaga do Campos, that for the last two years has been occupied in mapping the district, both topographically and geologically. Thus far only about one-half of the known ironfields of Brazil has been covered by this work which is of a reconnoissance, rather than of a definite character.

Communication with Seaboard

At present the only all-rail means of access is by the Central Railroad of Brazil, which, starting from the port of Rio de Janeiro, enters the district at its southern border at km. 493, traverses it in a north and south direction for a distance of 90 km. to Sabará and extends a branch transversely across it which, when completed to Santa Barbara, will have an extension of 60 km. This is government road with a gage of 160 cm. for 498 km. to the station of Miguel Burnier and 1 m. from that point onward. The Leopoldina Railway, a narrow (1 m.) gage road belonging to an English company, starting from the same port, with a present extension of 630 km. will eventually tap the district at its northeast corner at Itabira do Matto Dentro with an extension of about 87 km. The Victoria and Diamantina Railroad, also of meter gage and belonging to a French company, is now under construction from the port of Victoria, in the State of Espirito Santo, toward the same point (Itabira), which it can reach with an extension of about 630 km. It is understood that the company proposes to complete this line as soon as possible and to equip it especially as an ore-carrying road. If this is done and if the port of Victoria, which is an excellent one, is properly equipped with handling facilities, one of the most important parts of the district will have a satisfactory outlet in the near future.

Geology

The part of the region that has been mapped with approximate accuracy containing the iron-bearing formation, covers an area of about 5700 sq.km. The ore field is known to extend to the northward, northeastward and southwestward beyond the limits of the map which thus embraces only from a half to two-thirds of its total area.

In its essential geological features the region is constituted by a basement complex of crystalline schists (igneiss, mica, amphibole, chlorite and talcose schists), much injected with granite, and overlaid by a heavy series of partially metamorphosed sedimentary beds, profoundly folded and faulted. In this series, which consists principally of quartzites and clay slates with subordinate beds of limestone, a prominent member is the peculiar iron-bearing quartzite to which the name of "itabirite" has been applied. This name was originally proposed by Eschwege, in 1822, for the massive, pure iron ore of which the peak of Itabira do Campo, among others, is composed, and which is associated with a schistose rock composed of granular quartz and scaly hematite, which he discriminated as iron-mica schist. This shows all possible gradations from an almost pure quartz rock with scattered flanks of hematite to a massive hematite free from quartz. The latter presents itself as intercalated layers, or lenses, varying from a few millimeters up to scores of meters in thickness, alternating with leaner quartzose portions. When lime-

*Abstract of report prepared for the International Geological Congress, which is to meet in Stockholm in 1910.

†Chief of the Geological Survey of Brazil.

stones are associated with the series, they also are more or less heavily charged with flakes of hematite and are frequently associated with commercially valuable ores of both iron and manganese.

Three Classes of Ore from the Same Beds

Taken as a whole, the itabirite beds, which are often of great thickness, become, when exposed to the weather, extremely friable, and as the region is one of heavy rainfall (60 to 80 in.) they have been extensively denuded. In consequence of this, the massive portions, when they occur, stand out as topographical features; the rain- and wind-swept slopes become covered with a rubble of iron ore due to the breaking up of the thinner intercalated layers, more or less completely freed from the associated silicious elements by rain and wind action, and the bottom lands of the valleys become charged with deposits of iron sand separated by the natural sluicing of the streams. There are thus produced from the same series of beds three classes of ore, namely: (1) Quarry ore, in the peaks and other natural exposures *in situ* of the massive portions of the rock; (2) rubble ore, on the denuded surfaces; and (3) sandy ore, in the valleys where sluicing action has taken place. To these must be added a fourth class, the so-called "canga" (contraction of Tapanhoacanga, i.e., "Negro's Head"), due to the cementation by limonite of the rubble ore into a hard-stone conglomerate. It is probable also that still a fifth class might be recognized in the outcrops of quartz-hematite rock sufficiently friable to permit the separation of the metallic mineral by sluicing.

Estimated Deposits

The cubic contents of a limited number of the orebodies have been estimated by competent observers on the basis of actual approximate measurements of their outcrops, but for the most part this has been done by private parties, and the information is not available. The estimates made by Dr. Gonzaga de Campos, of the Servico Geologico, are believed to be as reliable as can at present be made, and will serve to give an approximate idea of what the figures may amount to when the district becomes better known.

ESTIMATES OF BRAZILIAN IRON ORE DEPOSITS.

	Cubic meters.
Gava	72,000,000
Conceicao	80,000,000
Esmeril	19,000,000
Caue (Itabira peak)	33,000,000
Pitanguy	14,000,000
Sao Luiz	8,000,000
Peak of Itabira do Campo	8,000,000
Rio de Peixe	10,000,000
Cocaes	3,000,000
Total	247,000,000

Taking the specific gravity of these ores as four, this volume represents 988,000,000 tons. The above list includes several of the largest-known deposits, so that the contents of the others cannot be estimated on a proportional basis; but it seems quite safe to assume for them at least an equal volume, which would double the above figures. In these estimates no account is taken of the presumed underground extension of the visible orebodies.

No attempt has been made to estimate the volume of the rubble-ore deposits, which are both numerous and extensive throughout the district. As regards the "canga," Dr. Gonzaga do Campos estimates that it covers about 10 per cent. of the area occupied by the iron-bearing formation, which is about 5700 square kilometers.

Quality of the Ores

As regards the quality of these ores, the analyses at hand are naturally of hand specimens only, but mineralogists and metallurgists who have examined the outcrops agree that on immense rock faces, such as represented in the peak of Itabira do Campo, no differentiation of richer and poorer portions is perceptible to the eye.

Most of these analyses are deficient from an industrial point of view, as in the majority of them the phosphorus contents is given vaguely as "traces," without accurate determination, and no reference is made to titanium, leaving it doubtful whether this element had been especially looked for or not. The iron oxide content is generally given as from 97 to 99.5 per cent., the remainder being almost exclusively silica. In two cases in which special tests were made for titanium none was found, and from this and other considerations it seems safe to assume that as a class these ores are practically free from it. The most reliable phosphorus determinations at hand are from samples from two different localities submitted to the Krupp works and to those of the United States Steel Corporation, both of which give the same result—namely, 0.0024 per cent.

Conditions in the Silver Mountain District, Arizona

Special Correspondence

The Silver Mountain mining district is situated in the south-central part of Yavapai county, Arizona, about 40 miles south of Prescott, and reached from the north by the Santa Fe, Prescott & Phœnix railway from Prescott. At the present time there is considerable prospecting being carried on. The more important properties now in operation are scattered over a large area and there seems to be no central point to which mineral is confined.

In general the district lies in what is known as Yavapai schist, a broad belt of silicious schist running from north to south and cut by immense iron, porphyry, diorite and silicious dikes, usually lying conformably with the bedding planes of the schist. The principal veins are either highly silicious, carrying a high-grade white iron pyrite, or great basic iron dikes on which deeper mining is required to uncover the heavier sulphides.

Among the more important mines is the old Crown King mine, about three miles northwest of Crown King. This property, on which several thousand feet of work has been done, was recently purchased by the Yavapai Consolidated Mines Company, owners of the Old Tiger and Wildflower mines in the vicinity.

The Crown King mine, with a credited production of over $2,000,000, has been closed for some time due to friction among the stockholders. The new company is preparing to work the property on a large scale and at present is cleaning out the levels, retimbering, and unwatering the 600-ft. shaft. The owners have been actively engaged in mining both in this district and in Tombstone where they are developing low-grade copper properties.

The Wildflower and Old Tiger mines have been gradually developed during the last five years and have several hundred thousand dollars worth of ore blocked out. It is expected that the owners, as soon as they get their various properties in good shape, will build reduction works at Crown King. The same men control the railroad and own an uptodate copper smeltery in the southern part of the territory.

The Ora Belle property, a steady producer for the last four years, is about two miles south of Crown King. At the present time it is sinking the 3-compartment shaft from the 400-ft. to the 600-ft. level. The Mascot and Savoy properties lie between Crown King and the Ora Belle. Both companies have good bodies of ore and are developing rapidly. At the present time the Savoy is figuring on constructing a dry-concentrating plant to treat the low-grade silver ores.

The Pacific copper mine is about six miles south of Crown King in the same belt of Yavapai schist before mentioned. The property consists of 30 claims. No ore has been shipped as yet although the owners have spent nearly $100,000 in development. The ledge is an immense iron gossan varying in width from 50 to 500 ft. On the surface it is leached and honeycombed, with considerable copper stain and some gold and silver.

The main shaft is now at a depth of 320 ft., at which point crosscuts are being driven to cut the ledge. As soon as these crosscuts reach the objective point sinking will be continued to the 500-ft. level. The shaft is equipped with a 25-h.p. gasolene engine. Several small shafts have been sunk on the property and one or two long crosscut tunnels driven; the present work will open the ledge at a greater depth.

Bad roads and expensive transportation have hindered operations in this district but the new Territorial automobile road, the survey for which was recently commenced, will pass within one mile of the Pacific mine and will undoubtedly be a great help to this section.

Mines of the Granby Consolidated, Phoenix, B. C.

Over Eight Tons of Ore Produced Daily per Man Underground; Electric Haulage Superseding Steam; Glory Hole Mining System

BY ROY HUTCHINS ALLEN*

Ore in the Phœnix camp was first discovered by Matthew Hotter in the summer of 1891 on the Knob Hill claim, now owned by the Granby company. The fact that the ore was of low grade and far removed from smelting facilities prevented the rapid development of the mines, but since the Granby company obtained possession, progress has been rapid until they have become the largest and most important in British Columbia.

Geology

The country rock, insofar as the ore deposits are concerned, is chiefly the old greenish volcanic breccia with bands of tuffs and ash, locally known as diorite. The breccia includes fragments of chert, argillite, porphyrite and limestone, with some of granite. The only body of limestone is a small mass near the north end of the intermediate level on the Old Ironsides claim. The country rock is cut by a large number of dikes of pink alkali-syenite porphyry, but only one dike has been found in close conjunction with the ore. There are also several volcanic plugs of basalt with lava flows, now more or less eroded. A number of the orebodies of the district have been found directly underneath the lava capping.

The country rock has been much fractured, probably during the period of volcanic activity or immediately following. The principal lines of fracture have a north and south trend, while between these the ground is intersected by a host of minor fractures. The former probably represent the main channels, the latter the distributaries, of the mineralizing solutions.

The ore occurs in vast irregular bodies as a metasomatic replacement of part of the limestones and tuffs by the ore minerals. These bodies have in general a north and south strike with a low dip to the east, up to about 30 deg. Some of the bodies, however, have their longer axes nearly at right angles to the above. They belong to what the Canadian Geological Survey has termed the "magnetic" type. The minerals in the ore are magnetite, chalcopyrite, pyrite, specularite, pyrrhotite, calcite, quartz, garnet, epidote and hornblende, together with less highly altered country rock. In addition to the copper the ore averages from $1.25 to $1.50 in gold and silver, these occurring chiefly in the chalcopyrite and pyrite. The ore is self-fluxing. The work of the Granby company is confined largely to the Knob Hill-Ironsides deposit, and to the Gold Drop claim a half mile farther to the east, but prospecting is being carried on in the intervening territory.

Mining and Transport of Ore

The Knob Hill-Ironsides deposit has been opened up by levels at 100-ft. intervals and the ore is extracted from both a shaft and tunnels. Near the top of the hill is a great "glory hole" over 1000 ft. in length and from 90 to 200 ft. in width. The ore here was formerly removed by steam shovels, but now all is drawn down through raises put up from the main haulage tunnels below. There are three of these tunnels, but tunnel No. 1 has been abandoned for some time and the bottom of the glory hole is now in places considerably below its level.

The No. 2 tunnel, 100 ft. below the No. 1, has nearly a mile of 36-in. gage track, using 30-lb. rails. The ore is handled in 10-ton steel hopper-bottom cars drawn in trains of 6 to 10 cars each by a 14-ton steam locomotive, using coke for fuel. In two 8-hour shifts 1000 tons of ore can be brought out. The engine produces an objectionable amount of steam and gas, and is to be supplanted by an electric locomotive similar to those in use on the other levels of the mine. The cars are dumped into ore pockets from which a 42x36-in. Blake crusher is fed. There is one of these crushers at each tunnel and one at the Victoria shaft. Each is driven by a 150-h.p. Westinghouse induction motor receiving current at 2000 volts.

The crushers have a rated capacity of 150 tons per hour, but on occasions this has been greatly exceeded. The two bins from which the crusher is fed, one on either side, are each provided with a finger gate, operated by compressed air. These gates have four double fingers made of heavy bar iron bent at nearly right angles. One end is pivoted at the chute opening. The fingers are raised simultaneously by a bar which passes under them, but when the air pressure is released each finger falls back by its own weight. The action of the gate is rapid and satisfactory.

The crushed ore, 7 to 8 in. in size, falls from the crusher on a belt conveyer discharging directly into Canadian Pacific railway cars in which the ore is taken to the smeltery at Grand Forks, 24 miles distant. If no railway cars are at hand the ore can be diverted into a pocket reached by a crosscut from the No. 3 tunnel.

Electric Haulage on Lower Levels

The No. 3 tunnel, 100 ft. below the No. 2, is of about the same length as the latter, and its equipment is essentially the same. The 10-ton cars are, however, drawn by a Baldwin-Westinghouse electric locomotive of 70 h.p. This locomotive has two motors, one on each axle, which take direct current at 500 volts supplied by a motor-generator set placed in the compressor house. The gates of the ore pockets which supply the crusher at this tunnel are made of six steel bars, 4 in. square, sliding in vertical guides. These bars are attached by chains to a cross-bar which is raised by compressed air. The bars fall by their own weight. This style of gate is very satisfactory, but no more so than the somewhat lighter and less expensive finger gate.

The broken ore from the crusher goes by belt conveyer up an incline of about 20 deg. directly to Great Northern railway cars. The crusher is run only when a car is under the discharge of the conveyer. Two thousand tons of ore have been hauled out of this tunnel, crushed and loaded in 24 hours. The crusher crew consists of one crusherman, one man to look after the conveyer and one carloader.

All ore below the No. 3 tunnel is dropped through chutes to the 400-ft. level, 300 ft. below the tunnel, and hauled by electric locomotive to the Victoria shaft, where it is hoisted to the surface. This shaft was sunk on an incline of 60 deg., and is about 500 ft. deep. It has three compartments, two for hoisting, each 5x6 ft. in the clear, and a ladder and pipe way, 4x6 ft. in the clear. The shaft is well timbered with 12x12-in. timbers. Seven-ton skips are used, hung in balance. These skips are provided with a hood, and guide shoes with safety clutches. The hoist, built by the Jenkes Machine Company, of Sherbrooke, Que., has a double conical drum, 7 ft. in diameter, and is driven by a 250-h.p. variable-speed induction motor taking current at 2000 volts. This motor makes 583 r.p.m. at full load, giving a hoisting speed of about 700 ft. per min. The time required for the trip averages about 1 minute and 10 seconds from the 400-ft. level to the dump. The output of the shaft is about 900 tons per eight-hour shift.

The headframe is 90 ft. from the collar of the shaft to the center of the sheave wheels. The skips dump about 60 ft.

NOTE—This article was written after a visit to the Granby mines, but many of the data have been obtained from articles by A. B. W. Hodges and A. M. Campbell in the *Trans.* of the Canadian Mining Institute.

*Mining engineer, Lunenburg, Mass.

above the ground and the ore can be run into either one of two coarse-ore bins, each holding 500 tons, These bins are provided with finger gates through which the ore is fed to the 36x42-in. Blake crusher. The product of the crusher drops to a belt conveyer on which it is carried up an incline of 12 deg. to the crushed-ore bins from which both Canadian Pacific and Great Northern railway cars can be loaded. The belt conveyer discharges into a hopper and chute which may be revolved about a vertical axis, and by turning the chute any one of the four bins may be loaded.

Side-dump Cars in the Mine

The levels tributary to the shaft are served by five-ton cars drawn by electric locomotives. The cars used on the 400-ft. level are built of steel, 5 ft. in hight, and have flat bottoms. They are hinged on the side of the running gear next the ore pockets, and have an automatic side-dumping arrangement. This consists of a side wheel, attached to the box of the car, which runs up an inclined plane placed opposite the shaft ore pocket, thus tipping the box and dumping the contents. As the wheel descends the incline the box returns to its original position. A small wheel attached to the side of the car truck and bearing against the underside of a guard rail attached to the frame of the inclined plane prevents a chance overturning of the truck. The gate is held in a constant position, independent of the position of the box of the car, by means of a scissors lever having one arm attached to the car truck. By this means the gate is automatically opened by the tipping of the car and is again closed when the box returns to its normal position. The speed of the train is slackened very slightly as it approaches the pockets, and the cars are dumped in rapid succession and with no delays.

The ore pockets hold about 400 tons and extend 40 ft. below the level. They are also connected with the two upper levels by raises, thus greatly increasing their capacity. The loading gates are of the finger type, similar to those in use at the crusher bins, but a sheet-iron gate rigidly attached to the arm operated by the air lift is placed below the fingers to prevent fine ore from running into the shaft.

Development Done by Contract

The tunnels and main haulage ways are all 9x11 ft. in the clear, though in actual measurement they average about 12x12 ft. These headings are driven by contract, as is all development work done in the mine, and cost approximately $7.50 per foot for labor alone. Four miners, two on a shift, with one machine drill will run from 110 to 130 ft. of 9x11-ft. drift per month. A twenty-hole round is used, made up of four lifters, four cut holes, eight breast holes in two rows, and four back holes. An 8x9-ft. drift was advanced 59 ft. in one week. The contractors furnish the two shovelers for loading the cars. In the breasts of the tunnels the ore is shoveled into special wooden, gable-bottom cars, 5 ft. in hight and holding seven tons. In the lower levels the 5-ton steel cars are used.

The orebodies are opened up on each level by a number of parallel drifts, approximately 75 ft. apart, driven along the strike of the orebodies. These drifts are 9x11 ft. in the clear where the big cars are used, and 8x9 ft. for the smaller cars. From the levels raises are driven at intervals of 25 to 60 ft., usually 45 ft. These are 7x9 ft. in the clear, and are put up by contract at a cost of about $5 per foot for the labor. Eighteer-hole rounds are drilled. In starting the raise two rounds are drilled and blasted and also the cut holes of the third round before the broken rock is removed. All of the rock is then shoveled up and the chute is built, after which the remaining holes of the third round are blasted and drilling continued.

From this point the methods employed differ slightly in various parts of the mine. The method most used is to carry the raises ahead at an angle of 45 deg. At a hight of about 30 ft. above the sill floor stoping is commenced and the raise widened out until it connects with those on either side of it. The ground between the raises is taken out for a hight of 10 to 15 ft., above which the raise is carried up 20 to 25 ft. wide until at a hight of about 60 ft. above the level another connection is made with the raises on both sides. In this way pillars about 20 ft. in diameter are left. Up to this point all drilling has been done with the machine mounted on a column. When the sill floor of the level above is reached the stope is widened out and a glory hole started. From this point tripods are used and the ore is broken down in benches.

Underground Glory Holes

It is frequently planned to bring the raise up behind the chutes on the level above. The timbers are then taken out and the glory hole started. At the same time the raise is continued upward 10 to 15 ft. underneath the old stope, and the intervening ore is broken down by long upper holes drilled from the raise. In this way the back is always within reach and there is little danger to the miners from falling rock.

A 3- or 3¼-in. Rand drill (No. 43, 43B, or 43¼) is used for both raising and stoping. The holes drilled in raising are from 6 to 10 ft. deep, while in bench work holes up to 20 ft. in depth are drilled. Air for the drills is furnished at 90 lb. pressure by two 30-drill Canadian Rand duplex two-stage compressors, each driven through a rope drive by a 700-h.p. slow-speed, alternating-current motor receiving current at 2000 volts.

Where the orebody is flat or very wide the raises are frequently put up as nearly vertical as possible, and when the hanging wall, or the sill floor of the next level, is reached, glory holes are started and the ore broken down in benches. In this case vertical pillars are left to support the roof. There is no timbering in the stopes, and aside from a few tunnel sets in portions of the haulage levels the only timbering used is that sufficient to carry the electric wires. All drifts, crosscuts and manways are electric lighted. Both trolley and lighting

GLORY HOLE ON KNOB HILL-IRONSIDES CLAIM OF THE GRANBY GROUP

wires are carried eight feet above the floor of the level in order to be out of reach of the men.

The ore chutes are made of round timber and are heavily constructed to withstand the effects of the frequent bulldozing. The posts are 18 to 20 in. in diameter and are set firmly in hitches in the floor and wedged securely against the roof. The space behind these posts is tightly lagged with 8-in. poles, an opening being left for the chute proper. At the sides of this opening and behind the lagging, posts are placed, surmounted by a cap 18 to 20 in. in diameter. The bottom of the chute is made of a double thickness of 4-in. planks.

The mouth of the chute is closed by an arc gate made of a single piece of heavy sheet iron operated by a lever. At a hight of 8 ft. above the bottom of the level a platform is built for the convenience of the car-men, both for loading the cars and for bulldozing the pieces of ore which are too large to pass the 36x36-in. chute opening. The platform has movable planks which may be shoved against the mouth of the chute to catch any fine ore should the gate be held up by coarse material. All blocks of ore too large to pass the chute opening are bulldozed, it being considered cheaper t use more powder in this way than to bother with drilling. Sixty per cent. dynamite is used for this purpose.

The methods employed at the Gold Drop property are essentially the same as those that have been described. All ore is dropped down to the level of the Curlew tunnel, which is several hundred feet below the upper workings, and there taken to the ore bins in flat-bottom wooden cars of three tons capacity, drawn by an electric motor. The cars have a side discharge and are dumped by an air lift.

The Granby company at the time of my visit was shipping 3300 tons of ore daily. There were about 500 men on the pay roll, approximately four-fifths of whom were engaged underground. This means a production of 6½ tons per day per man employed, or 8¼ tons for each man underground, a record surpassed by few mines. For each miner employed, there were about 20 tons of ore broken daily. Extensive improvements to the smeltery were practically completed and the output of the mine is to be increased to 4000 tons per day.

Iodide Assay for Copper

R. T. D. Williams (*Aust. Min. and Eng. Rev.*, April 5, 1909) contributes some notes on the iodide method for the determination of copper. The details described were used in connection with "Low's Modification of the Iodide Method." Highly ferruginous ores prevented the complete expulsion of nitric acid, even after evaporating to the densest fumes. This difficulty was overcome by taking a smaller quantity for analysis. It was also found that iron and silica interfered with the precipitation of the copper by aluminum. The unprecipitated copper was then precipitated by the addition of a little hydrogen sulphide water to the decanted liquor from the copper precipitated by aluminum. Bromine water was used to dissolve the copper sulphide and also served to oxidize arsenious compounds and assist in expelling nitrogen dioxide later.

The copper nitrate was evaporated to a syrup before neutralizing, which was done with a concentrated solution of sodium carbonate. The titrating was done in flasks and the bulk was from 75 to 100 cc. The reagents used should be tested for copper as the author often found it present in acetic acid.

Consolidated Goldfields of South Africa—A Criticism

SPECIAL CORRESPONDENCE

The general meeting of the Consolidated Goldfields of South Africa has been held and the report and accounts have been passed without opposition and with only a short discussion. The chairman's speech, which always attracts attention from the general public interested in South African affairs, was on the whole optimistic as regards the prospects of the company and the Transvaal gold-mining industry in general, and was well received by the shareholders. Outside, however, the speech has not been allowed to pass without unfavorable criticism. It is felt that the business of a company of the importance and reputation of the Consolidated Goldfields ought to be analyzed and explained in more detail than is done either in the directors' report or the chairman's speech.

The accounts of the company, for example, are presented only in lump sums. The shareholdings are given only periodically, and this year the list is omitted. The working results of the principal mines in which the company is interested are certainly given with considerable detail, but important information about the lives of these mines is either not given or referred to only in a casual manner. This is all the more surprising as the directors call special attention this year—and very properly—to the fact that the mines have limited lives and that therefore a portion of the dividends must be regarded as return of capital. If it is important for the Consolidated Goldfields to make provision by a sinking fund for redemption of capital, it is equally so for the individual shareholder, who has a right to all the information that the Consolidated Goldfields possess about the prospective lives of the subsidiary mines.

Then again, both in the report and the chairman's speech, new investments are dealt with only in the most general manner. Especially is this noticeable as regards the company's investments in West Africa. An important departure like this ought surely to be supported by a report from the company's engineer. When predictions are made that West Africa is some day going to be the biggest gold producer in the world, and the statement is put forward that four separate lines of banket formation have been found, the name of the authority should be given, for without that information the statements cannot be expected to make much inpression. Statements such as these put forward in such a loose and unbusinesslike fashion suggest that the directors do not realize their importance.

In discussing the policy of going outside the Rand for mining investments the chairman gave reasons which are to be deplored. He said that mining on the Rand had become prosaic and was an absolute certainty, and that he thought the shareholders wanted a bit of a gamble which he would find for them somewhere else in the world. Language of this sort is out of place at a company meeting and is not likely to impress shareholders.

Mining on the Rand, though exceptionally reliable as regards results, is not an absolute certainty and shareholders in such mines as the Robinson Deep or the Nigel Deep, two of the Goldfield's subsidiaries, will not agree that their operations have been prosaic. Neither will mining engineers agree that mining, when honestly conducted, and gambling have anything in common. Through their institutions and societies they have been doing their best for some time to make the public understand that mining is as respectable as any other business, and that while no doubt all mining enterprises carry some risk it is a risk that can be estimated and valued. Therefore when the chairman of the Consolidated Goldfields of South Africa, the trustee of millions of money invested by the public, couples mining and gambling together—although perhaps the remark was not meant to be taken too seriously—it is time for engineers to protest.

Gambling in mines means speculation in mines or mining property without good professional advice; it is a practice which in 99 cases out of 100 ends in disaster. Legitimate mining, on the other hand, is mining undertaken on the advice of competent engineers or geologists, and when conducted in this way the risk of failure should be small. It is on such lines that the shareholders of the Consolidated Goldfields or of any respectable mining company expect their business to be conducted; and when an opposite course is suggested to them by their chairman and the word gambling is introduced, whether playfully or not, they have good cause for taking alarm.

San Ygnacio Mine and Mill, Chihuahua, Mex.

Ore Deposits of the Small Sierras on Mexican Plateau Little Known; Success of This Mine Will Stimulate the Development of Others

BY ORESTE PERAGALLO

There is no question that much has yet to be done to develop the mineral resources of the small isolated sierras on the Mexican plateau and especially in the eastern part of the state of Chihuahua. New camps spring up here and there the ephemeral life of which is due, not to their lack of intrinsic merit, but to the absence of experience and want of capital on the part of those who try to promote the enterprises. One among these is the Sierra de la Magdalena, in the Bravos district, state of Chihuahua. In the north-central part of this range is a prominent landmark known as the Bufa de la Magdalena (Magdalena butte), east of Ahumada station on the Mexican Central Railroad, 85 miles south of El Paso, Texas, and reached by a good wagon road 18 miles long. Very few mountains offer such clear evidence of strong mineralization as this one, but no record exists of any property upon it which deserves the name of mine.

The monuments of the claims scattered through the country and the prospect holes found here and there show that some mineral ground has been taken up and several outcrops scratched, but apparently by people who are waiting for better times in which to work their claims. About 10 years ago rich silver and lead pockets were dug out, but only when Lewis Vidal, of El Paso, took hold of a group of claims did the San Ygnacio camp begin to be of some importance. To the seven properties Mr. Vidal bought he added several others acquired from the Mexican government; among these last ones I will take into consideration only three, called the San Ygnacio Anexas 1, 2 and 3, because they help to form a regular polygon of 155 acres with 10 titles, called the San Ygnacio group.

*Mining engineer, Chamber of Commerce building, El Paso, Texas.

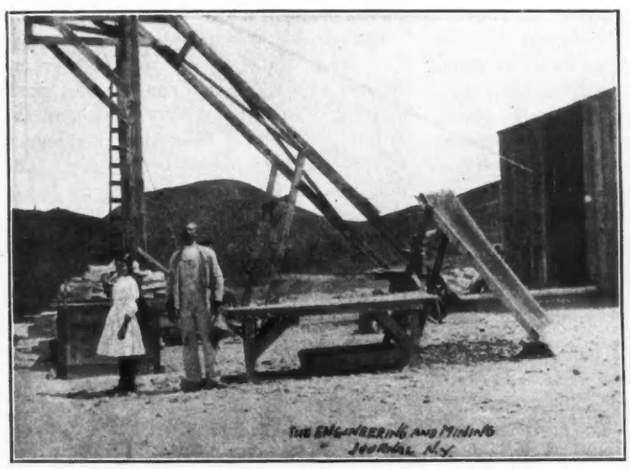
Geology

This group is formed by a basin about 3000 ft. long from east to west, and about 2000 ft. wide, limited by masses of igneous rocks, and the base formed by a thick deposit of sandstone which appears in all the arroyos. The ore deposits have two well defined characteristics; they occur as veins in sandstone along fissures perpendicular to the sedimentary planes, and as veins associated with intrusive dikes. In both cases the most remarkable features are: (1) The constancy of the strike (nearly east and west); (2) the great iron cap that forms the outcrops, and (3) the nearly constant vertical dip of the veins. Outcrops are formed by quartzose hematite of different colors and hardness, also limonite.

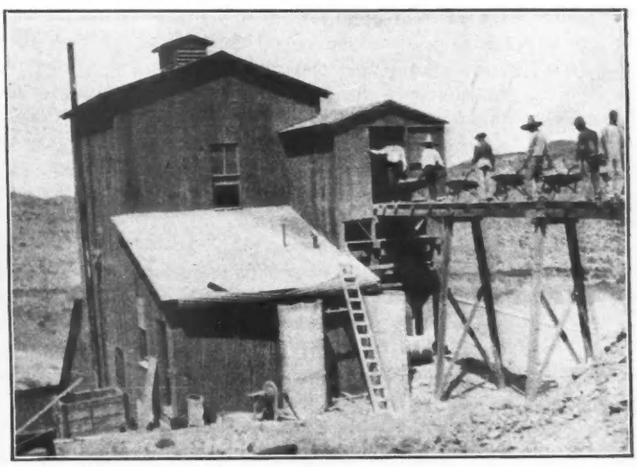
The sandstone strata, nearly horizontal, and from 1 in. to 3 ft. thick, are completely free from fossils, and in some places (especially near the surface) are found silicious knots of organic origin disseminated through them. Toward the south where they adjoin the eruptive material that forms San Ygnacio hill, they are slightly tilted over, but the place has not yet been found where they show plainly any of the metamorphism which they ought to have undergone when penetrated by the great mass of fluid eruptive rock shown in the hill. The sandstone exists only in this basin.

Magdalena butte rises due west of the camp, about two miles distant; it is surrounded by several other buttes, evidently chimneys of volcanic eruptions. All along the road to the railroad station there is no outcrop of sedimentary rock, although I remember that several years ago very close to the main butte on the south side, I found white crystalline limestone associated with fossiliferous strata, probably of the Cretaceous period.

The most important mine of the group is the San Ygnacio, near the east end of the property. The vein is a fissure in sandstone with about 5 to 10 deg. hade to the south. A study of this mine and others of the group shows the absence of folds and faults, and that after the formation of the ore deposits the topography of the country did not change save through erosion. This property, with the others, was opened as a lead-silver mine, and only when the percentage of zinc in the ore became so high as to prohibit the shipment to a lead smeltery was the attention of the owner attracted to the possibility of getting rid of the detrimental mineral by some mechanical process.



SAN YGNACIO MINE



SAN YGNACIO MILL

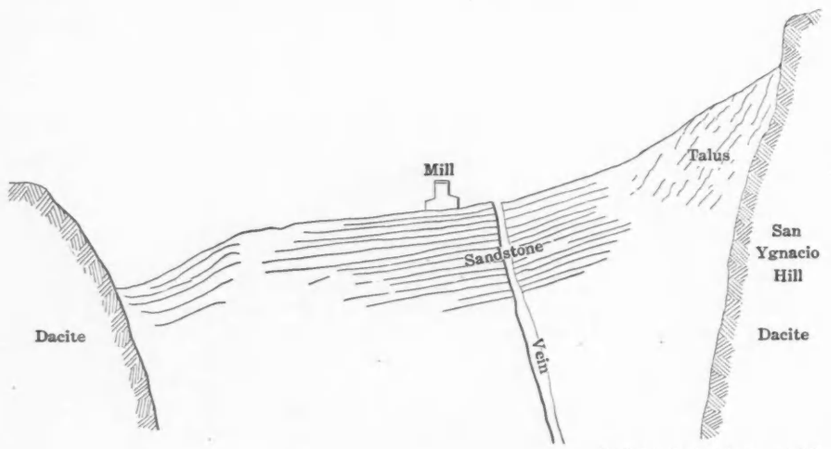
Contact Veins Most Productive

The width of the vein is variable, averaging from 2 to 4 ft.; it never pinches out entirely, and in some places the pay streak occupies the entire width. The gangue is formed by regular zones of calcareous crystalline deposit and by silicious matter and remains of the sandstone derived from the walls, but no foreign or brecciated

material is found. On both walls the slickensides are well marked, showing slips and probable shear zones. To reach accurate conclusions concerning the genesis of the ore would entail more detailed investigation, but data could be obtained from the examination of the several prospect holes scattered over the hills and from the study of the numerous basalt and porphyry dikes. My impression is that the veins that lie along the shear zones of the volcanic dikes posterior to the dacite of the buttes (because they cut it in some places), and along the contacts of eruptives and sedimentaries, have the same source as those intrusions, and have been filled with mineral deposits after the removal of the crushed material from the zone of least resistance. This was accomplished immediately after the period of most intense volcanic activity which brought up the dacite.

The veins in sandstone are the first that have been formed, and their origin is related to the big dacite eruption (probably Tertiary) that formed the buttes. The fissures have been opened, or rather widened, by the vapors and waters expelled from the solidifying igneous body; the hot ascending waters which succeeded the vapors in the cooling of the volcanic magna deposited the metals they carried in solution, and formed the ore. It seems to me that it is strictly a primary deposit, although the fact that the zinc sulphides increase in depth may show secondary enrichment. The most productive spots are in this class of veins, while the other veins, above referred to, have been proved entirely barren or low in grade. The organic matter of the sandstone has acted as precipitant for the lead and zinc sulphides. To explain the rich pockets of silver and lead found on the opening of this vein (and of another called the Carolina), it seems to me that as the solutions cooled and thinned near the surface the salts of silver were deposited, and afterward (in the oxidized zone) precipitated as chlorides by water containing chlorine, the lead remaining as insoluble sulphate.

The other vein, the Carolina, has this same character, but it is not so rich. This vein is about 1500 ft. west of the San Ygnacio, within the main property, but no efforts have been made to find out whether there exists any connection between the two veins or not. South of it, farther up the hill, a vein in dacite crops out and has been prospected with fairly good success. The talus that covers the slope conceals the sandstone at the point where it joins the dacite, and one may expect that some new mineral deposit will be found at this point of contact. This zone of contact is to the south and less than 1000 ft. distant from the actual workings, and is about to be proved by a tunnel from one of the arroyos in the center of the basin toward the butte that forms San Ygnacio hill. All the indications show that the vein is continuous and it would not surprise me should some large replacement be found in the contact zone, or in the probable zone of kaolinization. No analysis has as yet been made of the dacite and sandstone. Very little water has been encountered, except some seepage from the vein or joints of the sandstone (which sandstone becomes harder with depth), but the level of permanent water has not yet been found.



SECTION THROUGH SHAFT, SAN YGNACIO MINE

Economics

Water for the use of the camp is found in an old shaft in the vicinity, and rain is collected in tanks; also 150 gal. per day is bailed from the workings. The ore has been estimated at 20,000 tons in sight, blocked out from a single and nearly vertical shaft 500 ft. deep. This shaft, sunk on the vein, is explored through working levels. The levels are 10 in number and 50 ft. apart. After the removal of the iron cap from the upper levels, rich silver-lead ore was extracted to the amount of $260,000 as per smeltery returns. The main supply of zinc ore is obtained from level No. 7, where workings extend 225 ft. west and 150 ft. east, with a raise to the upper levels. The proportion of zinc increases at a uniform rate. The typical ore is blende and silver galena, spotted with iron pyrites. Assays of 3 per cent. copper and $1 per ton in gold have often been obtained. From the Carolina mine about $40,000 has been produced by shipping ore sorted by hand. During exploration of the San Ygnacio levels, 10 carloads of lead and two of zinc ore were shipped, mostly sorted and jigged by hand, and the returns from these shipments were $10,000. No complete sampling of the ores of the San Ygnacio mine has ever been made, but the average is about as follows: Ag, 15 oz.; Pb, 20 per cent.; Zn, 20; Fe, 3 per cent.

Treatment

The mill was designed to treat from 30 to 40 tons per day. Tests were made by Henry E. Wood & Co., Denver, Colo., but those made in Dallas, Tex., with the dry concentrator actually in use gave better results. At the time of my visit (June, 1909) the mill was nearly completed. Figures given below explain the results obtained after a few changes had been introduced, but no systematic tests or assays have been made as yet and no working records kept. The mill consists of a small building 26x60 ft. on floor plan, and the difference of level from dumping wagon to the discharge of product is 30 ft. The mill was designed and erected by James W. Searle, and cost about $15,000, but a new mill might be built cheaper.

The ore is crushed through a 7x10 Dodge crusher, goes to a set of 14x27-in. rolls of the Cananea type (built by the El Paso Foundry and Machine Company), then passes along a spiral conveyer where it is dried, then elevated and screened to 12 mesh. The fines are classified by a Sutton, Steele & Steele vibromotor, size 4, and oversizes, same as those from the screen, go to a set of finishing rolls, also 14x27-in., which discharge again into the spiral conveyer. The classified product from the vibromotor (from 18 to 200 mesh) goes to eight ore bins above two S. S. S. dry-concentrator tables, and the fines above 200-mesh go to tailings. The vibromotor, tables and the impact screen (from the Colorado Iron Works Company) are the only patented machines used. A 25-h.p. gasolene engine is used to run the blowers and tables, an independent source of power being necessary to give them a constant and uniform speed. A 32-h.p. gasolene engine is required to operate the other equipment.

The daily output of every table is about two tons of concentrates, which average 70 per cent. lead and 45 oz. silver. The zinc content is under smeltery penalty. The amount of ore run over the tables depends entirely upon the work of the rolls. The ore treated at present is first-class

ore, but they have on hand several old dumps of low-grade. The middlings are stored and will be treated later on by some magnetic process to get the zinc content out as soon as market conditions are favorable. In spite of the little troubles peculiar to every new mill of this kind, everything seems to be right and several carloads have already been shipped. To my knowledge the owner has no connection whatever with any large metal-selling company, and the successful outcome of his efforts with the present-day mechanical appliances that the mining industry has developed, will be watched with interest by every small producer.

Leasing Public Oil Lands

In connection with the recent action of the Administration in withdrawing from entry over 3,000,000 acres of public petroleum lands in California, Wyoming, Utah and Oregon, the following statement is given out by C. W. Hayes, chief geologist of the United States Geological Survey:

To remedy the present unsatisfactory conditions by which public oil lands have to be entered under a law framed primarily to provide for placer-gold mining entries, it is generally admitted by those interested in the development of oil lands that a radical revision of the American mining law is necessary. Anticipating that Congress will recognize and meet this evident need, the Secretary of the Interior has withdrawn from all forms of entry all vacant public lands designated by the Geological Survey as probably containing oil and gas. This executive action, is, however, only temporary, and is intended to preserve the *status quo* until Congress acts.

When the present placer-mining law was enacted probably no one in Congress or out had any idea that it would ever be made to cover mineral deposits so far removed in every essential characteristic from gold-bearing gravels as are oil and gas. Yet when oil was found on the public lands no other law was on the statute books except the placer law under which title to it could be acquired, and this anomalous and wholly unsatisfactory condition still holds—to the great detriment both of the Government and of the oil industry.

The fundamental basis of a location under the placer law is discovery, and the courts have held uniformly that there can be no legal location until there has been a discovery. But in the nature of the case there can be no discovery of oil until a well has been drilled at great expense, since ordinarily there are no surface indications of the oil and the well must be drilled upon purely geological inference. It follows, therefore, that the driller will be wholly unprotected against rival claimants to the land until he has completed his first well or he will be forced to make a false claim to discovery on which to base his location.

Fraudulently Entered as Gypsum and Agricultural Land

One very common method of evading the law is to locate oil under the guise of a gypsum claim. In many of the California oilfields the surface soil contains a small amount of gypsum, although rarely in sufficient quantity or purity to be profitably mined, even if favorably situated for transportation and market. It affords a pretext, however, for a location under the placer law, and large numbers of claims have been patented where it is a matter of common knowledge that the real object is to acquire title to the oil. In this way land worth thousands of dollars an acre has been acquired from the Government for $2.50 per acre, and this without oil development. Moreover, it is not generally the man of small means, but rather the wealthy corporation that resorts to this subterfuge to secure title.

Although many of the oilfields in the public-land States, and particularly those in California, are in regions wholly devoid of agricultural possibilities, no sooner is a successful well drilled than the entire district is covered by homestead and scrip entries, the purpose of which is to secure title to the oil under cover of the agricultural-land laws. It is to meet these conditions that a thorough revision of the law is needed.

Oil-leasing System in General Practice

Any law which will adequately meet the requirements of the case must recognize the fundamental difference between oil and gas and other minerals, namely, mobility. These elusive products can be drawn from a distance underground across boundary lines, and exclusive title to the product is acquired only after it reaches the surface. It follows, therefore, that oil can be disposed of by the Government or other owner of the land in which it occurs only as a commodity and not in terms of acres like coal or other minerals occupying fixed locations. This difference is so well recognized that it has determined the leasing system which is practically universal in all the oilfields where the land is in private ownership. The Government cannot do better than to adopt the plan which has been worked out through long experience, and, where the holdings are sufficiently large, found thoroughly satisfactory, both to the oil operator and to the private land owner. Why should not the Government as a land owner deal directly with the producer rather than through the intervention of a middleman to whom title to the land has passed?

Any ideal or practical law must further recognize the fact that actual discovery involves heavy expenditure and considerable time, and that the prospector must be adequately protected in his investment before as well as after the discovery is made. The area to which he is given a preferred right must therefore be sufficiently large to justify his initial heavy investment and in such compact shape as to protect his discovery from encroachment by drilling on subsequent entries.

A well considered leasing law will give certain incidental advantages of great importance both to the Government and to the oil operator. It will constitute the most effective means for the conservation of the oil and gas resources of the country by enabling the Government to regulate developments so as to prevent much of the criminal waste now prevalent.

Present Law a Hardship

Under the present system the owner of a 20-acre placer claim is compelled to drill and pump the oil from his land with all possible speed, regardless of transportation facilities or market, for otherwise his competitors on adjoining claims will take a large share of it away from him. In the resulting feverish exploitation half a dozen or more wells may be drilled when one would have secured the same amount of oil—a serious economic waste to the nation and a heavy tax on the ultimate consumer. Also, unrestricted drilling by careless or ignorant operators may ruin a valuable field by admitting water to the oil sand from a higher or lower water-bearing stratum. Many examples of criminal waste resulting from the unrestricted exploitation of oilfields might be cited.

Oil for American Naval Vessels

The Government is not only the largest owner of oil lands, but it is likely to be the largest consumer. The six largest battle ships in commission or under construction in the American navy are equipped for the use of either oil or coal, and the fourteen largest destroyers use oil exclusively. The question of fuel supply for these vessels is certain to become an exceeedingly important one in the near future, and the law should provide a means of perpetuating a supply for this certain future need.

The fact is gaining recognition that the natural resources remaining in the possession of the Government are the heritage of the whole people, and the idea that they should be utilized for the general good rather than exploited for the enrichment of a few individuals is rapidly crystallizing into public opinion. The enactment by Congress of a law providing for the leasing of oil lands will be a logical and much needed action in the Government's management of its great petroleum property.

Trial Runs with the Garretson Furnace

By Clarence C. Semple*

There appeared in the Journal of April 16, 1908, an article by the late Oliver S. Garretson relating to the furnace of his invention, in which he proposed reducing sulphide copper ores to metallic copper in one operation. This article was published after Mr. Garretson's death and dealt principally with the chemical and heat reactions involved. So far as I am aware, nothing has been published giving the details of the actual operation, wherefore the following notes on the results obtained in some experiments made with this furnace at Ore Knob, N. C., in the summer of 1905 may be of interest.

The principle of the furnace was based on the assumption that if an ordinary copper-matting furnace were provided with a crucible somewhat deeper than usual, and a suitable blast of air were blown into the bath of matte in the crucible, the iron and sulphur would be oxidized, as the grade of the matte raised, and the heat evolved would be available for the melting of more ore with attendant production of more matte to keep the crucible filled. The sulphur would escape upward through the charge and be carried off through the furnace stack, the oxidized iron would enter the slag and the matte in the crucible would be raised in copper content until metallic copper could be tapped.

Description of the Furnace

In the Ore Knob furnace, a cast-iron base plate, 2 in. thick, 42 in. wide by 108 in. long, was supported upon 10 cast-iron columns, 18 in. high. The sides and ends of the furnace consisted of two rows of water jackets. These jackets were of cast copper ¾ in. thick with a 4-in. water space. There were 18 jackets on each side of the furnace, 8 in the lower row and 10 in the upper. Each of these jackets were 12 in. wide by 4 ft. 6 in. high. The ends of the furnace were built up of water jackets similar to those used on the sides except the middle lower jacket at each end of the furnace was 16 in. wide. One of the wide end jackets was provided with a tap notch for drawing the matte from the crucible of the furnace and the wide jacket at the other end was fitted with slag notch and spout. There were seven jackets at each end of the furnace, four 12-in. jackets in the upper row, two 12-in. and one 16-in. in the lower row.

The upper 6 in. of the lower jackets overlapped, on the inside, the lower 6 in. of the upper jackets. The overlapping areas of the jackets were planed true and through each passed two 2-in. holes. The cooling water entered at the bottom of the lower jackets, rose in them, passed through the two holes into the upper jackets and from the upper part of the upper jackets entered a 5-in. pipe leading to a steel tank outside the furnace building, the bottom of which was a little higher than the top of the upper jackets. The excess of water overflowed from the steel tank. The tank was provided so as to insure the jackets always being filled with water.

The lower side jackets of the furnace were each provided with two tuyere openings of 2-in. diameter, the centers being 18 in. above the base plate of the furnace. These tuyeres were called the "smelting tuyeres." Twelve inches below the smelting tuyeres, each jacket was provided with three other tuyeres, 11/16 in. in diameter, which were known as the "converting tuyeres."

The discharge lip of the slag spout was 14 in. above the base plate of the furnace, and arranged to trap the blast in the usual manner. The tap notch in the wide center jacket at the other end of the furnace was 6 in. above the base plate.

The hood of the furnace was built of brick and supported on three sets of 16-lb. rails. There were two stacks in the hood, each 30 ft. high and 37 in. in diameter. A steel feed plate 12 in. deep held the upper jackets in place and added a foot to the depth of the furnace. The furnace had the form of two rectangular prisms, the larger above the smaller. The overlapping of the jackets resulted in there being a 6-in. shelf-like projection all around the inside of the furnace. There was no bosh whatever. The lower prism measured inside the furnace, 29 in. wide, 108 in. long and 54 in. deep, the upper, 41 in. wide by 120 in. long by 48 in. deep so that including the depth of the feed plate the distance from feed floor to base plate was 9 ft. 6 in. There were 16 smelting tuyeres and 24 converting tuyeres on each side of the furnace. The bottom of the furnace was made by tamping in a 6-in. layer of brasque.

The forehearth was water jacketed and lined and bottomed with fire brick, the dimensions inside the brick being 52 in. in diameter by 36 in. deep. The forehearth was provided with a slag overflow, and a tap notch 6 in. above the bottom.

Operation of the Furnace.

Blast was supplied to the smelting tuyeres by a No. 3 Roots blower. The converting tuyeres were supplied with air by a Laidlaw-Dunn-Gordon compressor capable of supplying 2400 cu.ft. of free air per minute up to a pressure of 18 lb. The smelting and converting tuyeres were supplied through independent blast pipes.

The ore used was taken from the old waste dumps of the Ore Knob mine, carefully picked over and broken to 3-inch size. All fines were carefully screened out. A typical analysis of the ore showed: copper, 1.4 per cent.; alumina, 3.93; silica, 12.5; iron, 41.7; lime, 6.8; sulphur, 26. The ore was a heavy pyrite ore composed of the minerals pyrite, pyrrhotite, chalcopyrite, quartz and a small amount of calcite. Connellsville coke was used for fuel and the only flux was an almost pure white quartz taken from the creek bottoms.

After thoroughly drying the brasque bottom, a wood fire was kindled and a bed of burning coke built up to about 12 in. above the tops of the smelting tuyeres. The converting tuyeres, slag and matte taps were plugged and the blowing-in charges fed. These blowing-in charges were made up of first 6000 lb. of slag, followed by 400 lb. of coke, and 2000 lb. of slag until three such charges had been fed, then the regular ore charges of 2000 lb. of ore, 200 lb. of quartz and 7 per cent. coke were fed until the furnace was three-quarters filled. Blast was then supplied at 10-oz. pressure through the smelting tuyeres and gradually raised to a maximum of 30 oz., two hours after the first blast had been turned on.

As soon as the forehearth had half filled with matte and the regular ore charges had reached the zone of fusion, the amount of quartz on the charge would be raised to 400 lb. per ton of ore and the coke cut to 4 or 5 per cent. of the charge. It would take about 40 min. for this charge to reach the fusion zone, then the converting tuyeres would be opened at a pressure of about 10 or 8 lb. Before opening the converting tuyeres the furnace would smelt at the rate of about 125 tons of charge per 24 hours; after putting on the converting blast the smelting would run slower for about 40 min. then increase to the rate of 175 to 200 tons of charge.

Bridging of Charge

In the first experiments, we had great trouble usually about six hours after turning on the converting blast. An arch of chilled material would form across the furnace about 2 ft. above the level of the smelting tuyeres, eventually stopping the blast entirely and freezing the furnace completely.

By taking down the end jackets we could have a good view of this arch and generally found it hung with stalactites of material which upon analysis proved to have the composition of Fe_3O_4. We were rarely troubled with an actual chill in the crucible of the furnace, the chills being generally confined to the formation of the arch above the smelting tuyeres. We did have much trouble in keeping the converting tuyeres open; before turning on the converting blast, slag and matte would chill around the lower tuyeres and form noses that were hard to break off

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when we wished to open the converting tuyeres. These noses would also form nuclei of chills around the lower tuyeres which would not spread so as to fill the crucible but upon being broken off would soon build up again.

Apparently the trouble was caused by the lack of silica to combine with the iron oxide formed by the conversion of the matte at the moment of opening the lower tuyeres, and also due in part to the chilling effect of the jackets on that part of the matte immediately surrounding the converting tuyeres. Lining the crucible was then tried. A mixture of broken quartz, with just enough clay to bind the particles together, was rammed between the jackets and a wooden mold in the crucible of the furnace. This lining was made 6 in. thick and carried up to within 3 in. of the smelting tuyeres. Holes were punched for the entrance of the converting blast and opposite the slag notch. After drying this lining the furnace was blown in as before and from that time on we began getting encouraging results.

Operating with Quartz-Lined Crucible

After putting in the clay lining a typical run of the furnace would be about as follows: The blowing-in charges as before mentioned were fed, followed by a regular ore charge of 2000 lb. of ore, 200 lb. of quartz, with 7 per cent. coke until the furnace was filled. The blast was turned on through the smelting tuyeres at a pressure of about 10 oz., this being raised to 24 or 30 oz. two hours later. The charge would melt down quickly, the furnace producing about one-half as much matte as slag. The slag, while basic, ran hot and limpid, a typical analysis of which would show: Silica, 34.4 per cent.; iron, 37.5; lime, 7.6; alumina, 6.3; sulphur, 0.8; copper, 0.35. The corresponding matte carried 3.2 per cent. copper, 60 per cent. iron and 30.4 per cent. sulphur. Approximately 60 per cent. of the sulphur in the ore went out the stack.

After the regular charge had reached the fusion zone the coke would be reduced gradually to about 3 per cent. of the weight of charge. The amount of quartz raised to 400 lb. per ton of ore and as soon as the slag began to show acid the converting tuyeres would be opened at a pressure of 8 lb., gradually raising it to 10. The immediate effect of opening the lower tuyeres would be to cause slower running for about an hour, then the furnace would begin to run faster until it took about 50 per cent. more charge than when running with the smelting tuyeres alone. The clay lining would be gradually eaten away and completely disappear in 40 minutes, but by that time conditions in the crucible would be such that no chills would form in front of the tuyeres and we could shut them off and open them again at will.

Dark Tuyeres

Soon after the lower tuyeres had been opened the smelting tuyeres would darken and in spite of constant punching could not be kept open nor could any blast be driven into the furnace through them. A bar could be driven from a smelting tuyere on one side out through the tuyere opposite and be withdrawn with the bare hand. The smelting blast was cut off altogether after the tuyeres had darkened, but the furnace ran exactly as well with only the lower tuyeres in commission.

About an hour after the lower tuyeres were put in blast no matte at all could be observed overflowing with the slag. In 24 hours we would hardly tap a pot of matte from the forehearth. With 400 lb. of quartz to a ton of ore and with the converting blast on, a slag would be obtained showing the following analysis: Silica, 37.4 per cent.; iron, 38.7; lime, 5.4; alumina, 3.2; sulphur, 0.5; copper, 0.15. The corresponding matte ran 9.8 per cent. copper.

Shortly after opening the lower tuyeres, the quartz on the charge would be again raised to 600 lb. per 2000 lb. of ore and the slag obtained showed: silica, 39 per cent.; iron, 38.5; lime, 3.9; alumina, 2.5; sulphur, 0.4; copper, 0.2. The coke was oftentimes reduced to 0.95 per cent., and one time we ran for five hours with no coke at all.

The slags ran from the furnace white hot and smoking. They were very limpid, cooled exceedingly slowly in the pots and usually showed a glassy surface or fracture when cold, and although rather high in iron, the little matte that came over in the slag seemed to settle rapidly and cleanly. Both the slags and mattes were magnetic, and could be entirely lifted with a magnet when ground to powder.

Furnace Conditions

The furnace always ran with a cold top showing no signs of fire, the charge was kept level with the feed floor and great volumes of bluish- and yellowish-white smoke rose to tax the carrying capacity of the stacks. This sulphur smoke would often settle about the smelter yard to the great annoyance of the slag wheelers who oftentimes could not work more than half the shift. It was often possible to account for only 2 per cent. of the sulphur charged with the ore in the slag and matte obtained, 98 per cent. of the sulphur being burned off.

The converting capacity of the furnace often exceeded the rate of matte production so that the line of matte in the crucible would sink below the lower tuyeres, allowing slag to come in front of those tuyeres which would immediately chill and cause trouble. The number of converting tuyeres in blast would then be decreased and charges of old low-grade matte with sufficient quartz to flux the iron be charged until the lower tuyeres were again submerged. We had no trouble with the lower tuyeres as long as they were submerged in matte. The amount of air supplied the furnace was about enough to oxidize all the iron to FeO and three-quarters of the sulphur to SO_2.

Copper Content of Products

Samples of the matte and slag taken from time to time after the converting tuyeres were put in blast were analyzed and the copper content is shown in the accompanying table.

COPPER CONTENT OF MATTE AND SLAG.

	Matte, Per Cent.	Slag, Per Cent.
Before converting began	4.57	0.35
5 hours after converting tuyeres had been in blast	8.08	0.15
17 hours afterward	32.12	0.18
18½ hours	41.75	0.40
20 hours	45.64	0.40
25 hours	56.83	0.42
30 hours	62.29	0.45
In crucible after blowing out	69.25	....

After using the clay lining in the crucible the results obtained were most encouraging and in not a single instance did we have trouble with the furnace. A series of accidents to the pumping machinery obliged us to cut short the experiments when they had reached such a satisfactory state and Mr. Garretson decided that he would discontinue the trials as he wanted to redesign the furnace so a deeper bath of matte could be carried in the crucible to do away with the annoyance of having the matte line drop below the lower tuyeres.

The high copper in some of the slags made while converting is probably due to the insufficient size of the forehearth. The stream of slag from the furnace was so large that the little forehearth gave practically no chance for any entrained matte to settle out.

No attempt was made in the experiments to eliminate sulphur in the shaft of the furnace; the charge was melted down to produce the maximum matte fall possible without regard to its copper content, all the concentration being left to be accomplished in the crucible. I am not aware that the furnace has ever produced metallic copper, but even if such a degree of concentration should be impossible or not economical there would seem to be a field for a furnace capable of producing such a high degree of concentration as 40 to 45 into 1 with the use of so small a percentage of carbonaceous fuel. An ore with considerable sulphur and high in unoxidized iron that upon melting down would result in the production of a heavy matte fall, with sufficent silica to meet the requirements of the oxidized iron to form a liquid slag would, from the results of our experiments, seem to be the class of ore the furnace could work upon to give most favorable results.

Separate Leaf System for Recording Survey Notes

Enables the Office to Keep Pace with Field Work; Only Notes of Work in Hand Are Carried; the Installation Cost Is Quite Nominal

BY LEE FRASER*

The system herein described for the taking and recording of survey notes, suggested by a system in use at the Tamarack mine and inagurated by John T. Been, has been devised with the intention of facilitating the labor of this work, insuring its accuracy and guaranteeing the ability at all times to instantly refer to any notes or records.

Field Notes

The field notes are taken upon cards, as shown in Figs. 1, 2 and 3, while the office record is shown in Fig. 4. A blankbook of 100 pages of convenient size, numbered and securely bound, completes the office record.

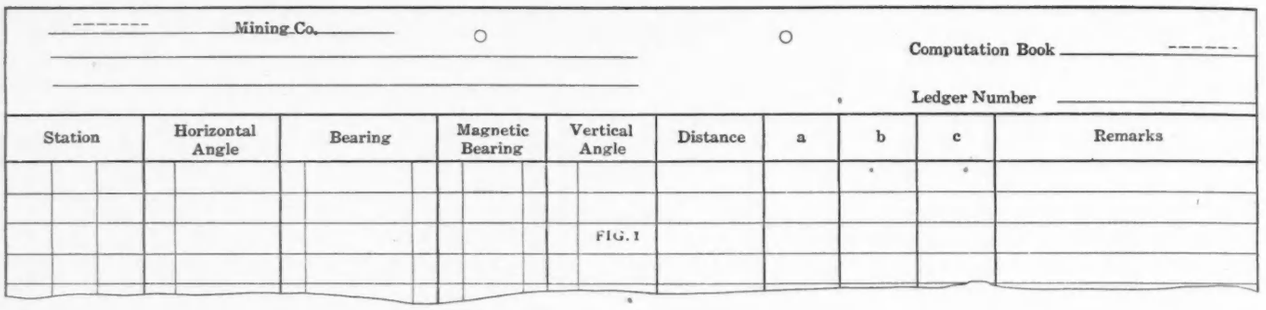
The field cards consist in a card ruled for transit notes, and one for level notes, together with a cross-section card for sketching. The size of these cards is approximately 5x8 in., a stock size. The weight of the board may be chosen with a view to its probable use, thus a card for mine notes may be heavier than one for notes to be taken under more advantageous circumstances.

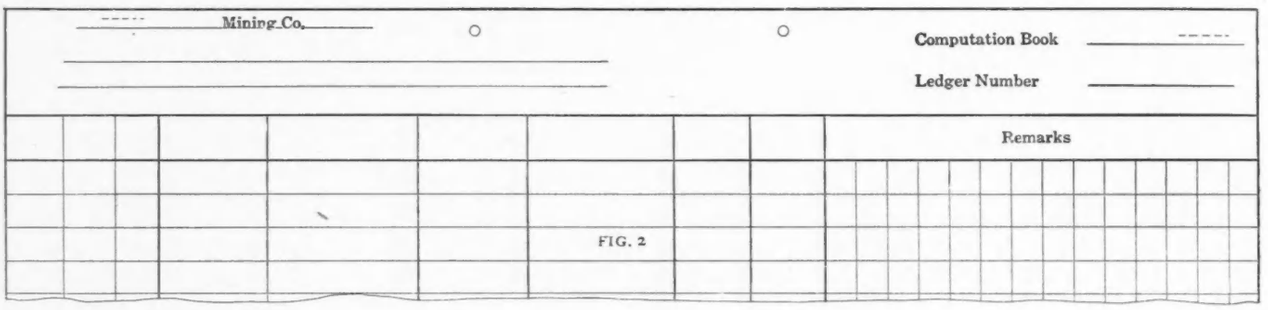
When in the field the cards may be bound in a loose-leaf binder. It has been found that notebook covers of heavy sheet tin, to which the binder is soldered, give satisfactory service, especially underground. The covers should be made of sufficient width to afford ample protection to the edges of the cards, and, if necessary a clasp provided, but this it not recommended. The cover corners should be rounded.

The field notes may be filed in the manner most convenient to the one using them; an alphabetical classification gives good results.

Office Record

The office record is in loose-leaf form, size of sheet about 14x30 in., and may be bound in a ledger or filed under an alphabetical index, as in a card system. The scheme as portrayed in Fig. 4 was adopted to minimize the labor and drudgery, but more especially to give a direction or definition to the work. The *modus operandi* will depend in any case upon the one calculating but in general may be described as follows: (1) Record field notes; (2) Find corresponding logarithms; (3) Add logarithms and find corresponding numbers, recording results under Latitude and Departure, a; (4) Compute latitudes and departures by traverse tables, b; (5) Compute latitudes





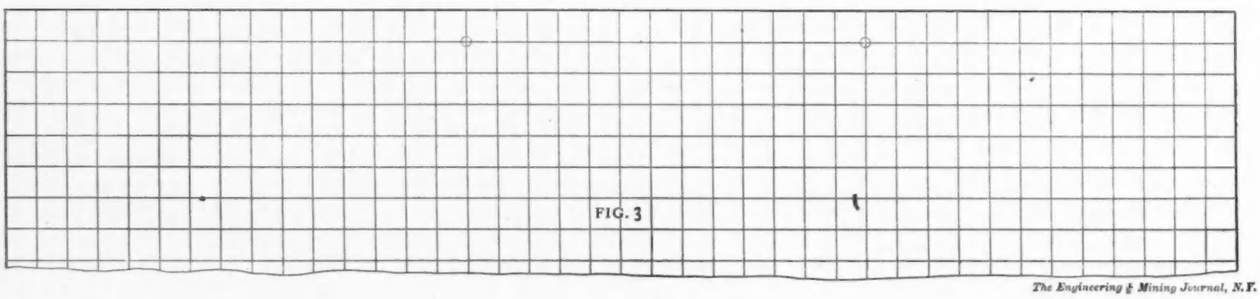


FIG. 1. TRANSIT CARD FIG. 2. LEVEL CARD FIG. 3. SKETCH CARD

*Mining engineer, Aguacate mines, San Mateo, C. R.

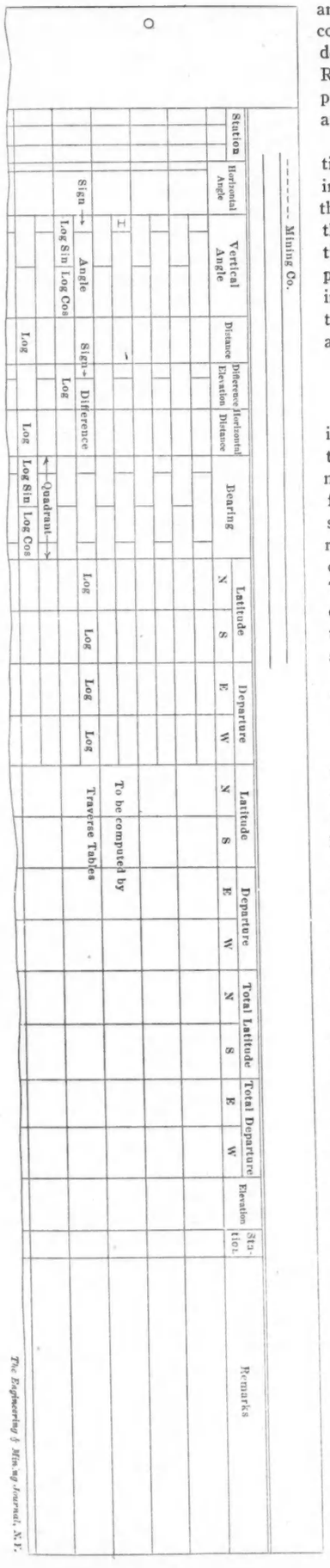


FIG. 4. LEDGER SHEET OF SEPARATE LEAF SYSTEM FOR SURVEY NOTES

The Engineering & Mining Journal, N. Y.

and departures by both methods and record average; (6) Compute total latitude, departure and elevation of the point; (7) Record under Remarks the number and page of the computation book in which any calculations were made.

From the above description of the routine to be performed it is evident that in this system figures are handled twice, there is a definite program to be followed, thus avoiding confusion, and the operations progress in a logical order. A complete record of all operations up to and including the final results is thus maintained and the work is always readily accessible for future reference.

Cost of Installation

The cost of installing such a system is not great, and certainly warranted by the results obtained. A zinc etching made from drawings representing the form to be used, gives satisfactory results, and the cost of such an etching varies from 6 to 8c. per sq.in. A notebook cover, as described, costs about $1.50. The sum of $50, including the cost for etchings estimated at $35, should cover the entire expense of installing such a system.

General Advantages of the Separate Leaf System

For the work about a mine, which often includes a little of almost every sort of surveying, cards have been found superior to regular field books on many points. To begin with, by their use a complete and continuous record of the work is maintained, regardless of the date the notes were taken. Then too all notes are readily accessible, and in the case of the sketch cards, they may be laid out to represent a continuous and connected sketch of a road, railroad line or profile stope, drift, tunnel, etc. Another great advantage is that all data, information, and notes, except those actually in use in the field, are always available in the office. This feature is to be particularly commended. Another great advantage is that the engineer in the field does not carry the notes of other surveys with him, which might easily be the case if he carried a half-filled field book, especially when there is a volume of disjointed survey work to be kept up, faces to be measured, etc.

As a usual thing, the notes, in either case, may be taken clean, and, with the cards, they may be filed at once in the office. When a survey party is in the field it is an easy matter, if separate cards are used, to send the notes of the day's work to the office, there to be plotted by the office man; this might be awkward if books were used, and the distance to the office great. This plan has also worked out well in some railroad surveys for preliminary location. Special forms for sketches in constant use, for example of the rooms off an entry in a coal mine, may be printed and will facilitate the work.

Determination of Iron in Brass and Bronze

I. M. Bregowsky and L. W. Spring (*Journ. Ind. and Eng. Chem.*, I, pp. 187-188) find appreciable amounts of iron present in brasses and bronzes where other chemists report traces or small amounts. Check results are usually obtained on the main constituents as tin, lead, copper and zinc. This difference on the iron content they believe to be due to the methods used, as they have found that their method in the hands of other chemists gives check results. Their method is based on the fact that appreciable amounts of iron are retained in the ignited stannic oxide. The procedure is as follows:

One gram of the borings is dissolved and run down in nitric acid (1.42) and the metastannic acid filtered out as usual and ignited to stannic oxide in a clean weighed porcelain crucible. One gram of c.p. sodium carbonate and 0.25 gram of sublimed flowers of sulphur are added to the stannic oxide after weighing, the crucible covered and the mixture fused at a very low heat until the excess of sulphur is burned off. When cold the crucible and cover are immersed in 50 c.c. of distilled water in a No. 1 beaker and warmed to disintegrate the melt. The crucible and cover are then rinsed and removed. A blue or green solution indicates soluble iron which can be precipitated by the addition of a little ammonium chloride, leaving the solution a light yellow. The ferrous sulphide is filtered out, washed with hydrogen sulphide water, dissolved from the filter, and the iron determined volumetrically or gravimetrically. Correction for the iron as oxide in the stannic oxide should of course be made.

The lead and copper are removed from the original filtrate, the filtrate brought to a boil and the iron oxidized with a few drops of nitric acid and then precipitated with an excess of ammonia. The precipitated hydroxide is best settled out if the solution is kept at just the boiling point with not more than a bubble ascending now and then. Then hydroxide is filtered off, washed well and the iron determined by any of the usual methods. Blank determinations should be run on all the chemicals.

The authors have seldom found brasses with less than 0.4 per cent. iron and often as high as 0.9 per cent. and over. As a rule, approximately half of the iron content is retained in the stannic oxide.

Iron Ore Deposits of Eastern Texas

SPECIAL CORRESPONDENCE

The daily papers have published a number of accounts of proposed developments in the eastern Texas iron-ore region. The facts appear to be about as follows: The Bethlehem Steel Company has become interested in these ores with a view to shipping them coastwise through Port Bolivar or Texas City. The ore is limonite (brown ore), and carries from 54 to 57 per cent. iron, with phosphorus above the bessemer limit. About two years ago several thousand tons of this ore were shipped to Birmingham, Ala., on an all-rail rate of $2.20 per ton. The analyses of these shipments showed that the ore carried above 57 per cent. iron and from 0.12 to 0.15 per cent. phosphorus, with low sulphur. It is almost an ideal ore for basic iron, especially for malleable consumption.

There are but few of the deposits that require washing, most of the ore occurring in masses free from sand and clay. The expense attending the installation of washers and a large water supply for the same, as is required with the brown ore of Tennessee, Alabama and Georgia, will not be necessary in Texas, except at a few places. The ore occurs as a capping on the sand hills of nearly all of the eastern counties of Texas. It is probable that it can be mined and put on cars for $1 per ton and this cost should not at any place exceed $1.25 per ton. The rate to Gulf ports has not yet been established by the Texas railroad commission, but the facts in the case are now before this body and an early decision is expected.

While it is perhaps too early to venture an opinion, yet it is thought that some business will result from the present negotiations. Some metallurgists advocate an increased proportion of brown ore in furnaces making basic iron, whether for the steel furnace or for malleable purposes. There is a marked decrease in the consumption of coke per ton of iron and the grade of the iron is better and more uniform. There is enough ore of this kind in Texas to supply a large demand and it now looks as though the deposits would be developed.

Quartette Mining Company, Nevada

The annual report of the Quartette Mining Company, Searchlight, Nev., for the fiscal year ended Sept. 30, 1909, shows a production of 28,316 tons of milling ore of an average grade of $8.72 per ton. In addition to this, 48 tons of a gross value of $70 per ton, were shipped to a smeltery. The mining costs are given at $2.99 per ton, inclusive of cost of 4518 ft. of development work done during the year.

The ore was milled in a 20-stamp mill and the tailings cyanided. The stamp-milling charges are given at $1.01 per ton, and a saving of 70 per cent. was effected on the plates. In the cyanide plant, 35,740 tons of tailings averaging $4.78 per ton were treated with an extraction of 77 per cent., at a cost of $1.62 per ton.

Crucibles of Nickel Instead of Platinum

The use of a nickel crucible instead of a platinum one for the determination of carbon in steel is described by H. E. K. Ruppel in the *Journ. Ind. and Eng. Chem.*, I, pp. 184-187. The substitution of the cheaper nickel for the more expensive platinum-ware recommends itself especially to those laboratories where the number of carbon determinations performed is limited. Nickel, besides being inexpensive, has a high melting point and resists oxidation well. A conservative estimate of the life of these crucibles when the solution method is used, is from 30 to 50 determinations. The crucibles are made as simply as possible, with a separate water jacket not directly attached to the crucible, to allow for the shorter life.

The nickel crucible is 1⅞ inches deep, 1 9/16 in. in diameter at the mouth and is provided with a flange about 9/16 in. wide. A brass rim soldered with silver solder may be used if the crucible is not supplied with one. The area of the bottom is comparatively large so that all the carbon might be in contact with the bottom, even though the asbestos pad is large. Unburnt carbon is sometimes found in platinum crucibles in which the bottom area is small and the asbestos pad and wipings extend up the sides of the crucible. A deep crucible also aids in overcoming this dufficulty.

The crucible rests upon an annular water jacket of machined bronze casting, 2¾ in. outside diameter, 1 9/16 in. inside diameter and ⅝ in. high with walls about ⅛ in. thick. Two brass tubes, ¼ in. outside diameter and ⅛ inside, are soldered into holes bored in opposite sides of the ring. Three brass stud bolts, 3/16 in. in diameter, project upward from ears spaced 120 deg. apart on the ring. The cover has corresponding ears with holes bored in them through which the stud bolts pass and by means of winged nuts the cover is clamped to the ring.

The cover is also of cast bronze, 2¾ in. in diameter, ⅞ in. high with walls about ⅛ in. thick. A brass tube ⅛ in. inside diameter is inserted and soldered into one side and a similar tube fastened into the top. The flow of cooling water is through the cooling ring and then through the side tube of the cover and out the top. The air enters the crucible through a tube which passes through the cover and extends 1¼ in. below and leaves through another tube which just passes through the cover. An ordinary rubber gasket is used to make the joint tight between the crucible and cover. The cost of the crucible is $1.10 and the cover and jacket about $7 exclusive of patterns.

The crucible is supported through a hole in a piece of asbestos board ¼ in. in thickness and is heated to a bright redness for ⅜ to ½ in. from the bottom by means of a small upright blast lamp. The time of heating is ½ hour for steel and ¾ hour for cast iron. A modified form of a Gooch crucible funnel is used in filtering in which the hight of the funnel above the stem is about 1 in. A copper wire with a close spiral at one end passes through the stem, loose asbestos is placed on it and then asbestos suspended in water. Suction is applied and the asbestos gently tamped into place with the flattened end of a glass stirring rod. This makes a pad of ¾ to 1 in. in diameter and about ¼ in. thick. The bottom of the crucible is protected by a false bottom of sheet platinum which fits snugly and extends about ¼ in. up the sides. The pad is placed in the crucible with the carbon down and the crucible loosely filled with ignited asbestos.

The combustion train consists of a small pre-heating furnace holding a 12-in. porcelain tube filled with copper oxide, followed by a Liebig bulb with potassium hydroxide and then a small guard tube. Following the crucible is another furnace with tube of copper oxide, a tube of beads moistened with water, a Marchand drying tube and the Geissler bulb and guard tube.

When the crucible is used for direct combustion, the bottom is filled to a depth of about 1/16 to ⅛ in. with ignited aluminum oxide, which is tamped down in the middle. Three grams of steel are carefully placed on the aluminum oxide so as not to touch the sides of the platinum. The crucible is then filled with loose asbestos and the steel burned for 30 min. in a current of oxygen, followed by a current of air for 30 min. to remove the oxygen. The steel samples used for direct combustion consisted of pieces about 1/16 in. square and 0.006 in. thick. The iron oxide is removed from the crucible by withdrawing the platinum shell. The platinum shell should occasionally be removed to prevent its adhering to the crucible.

A comparison of results using the double potassium copper chloride solution method with both nickel and platinum crucibles indicates that the nickel crucible can be safely substituted for platinum. Results by direct combustion and by the solution method with the nickel crucible were equally satisfactory.

Instantaneous Outbursts of Gas in Shaft Sinking

There has been much discussion as to the nature of gases occluded in coal seams, and some question as to the pressure under which this gas has existed. Sudden outbursts of gas in American mines are not common, and as a consequence, the following description of an occurrence at a mine in the Gard coalfield in France is interesting:

At the Rochebelle mines, June 7, 1905, when more than half a mile of drifts had been opened, the first outburst of gas took place in a rise heading, blowing out 280 tons of material, and filling the mine with carbonic acid. This gas rose through the shafts and spread over the surface to some depth above the pit top. This outburst was followed by 50 others, in 10 of which the material displaced exceeded 500 tons.

The first seam having been found to dip steeply eastward, the sinking of the new pit was resumed during 1906, and on the twenty-fifth of October, after a round of 13 shots were fired in a sandstone bed at 235 m., a violent outburst of carbonic acid ensued, which rising to the surface made the ground about the fan outlet inaccessible for nearly an hour, while the coal dust projected invaded the engine house and other surface buildings and filled the pit to a hight of 26 m. above the bottom. In cleaning up, 560 tons of coal and 280 tons of shale and sandstone débris were removed.

The blower of gas was traced to a coal seam about 2 ft. below the bottom of the pit at the time the shots were fired. This was the first time that this gas has been encountered in pit sinking, but a few months later it was followed by a more violent outburst, unfortunately attended by loss of life. On July 5, 1907, at a depth of 322 m. the pit bottom was in a coal seam, and the shots fired in the afternoon broke out a depth of about 1 m., the pit being 5 m. in diameter, without any gas being observed. When, however, the next round was fired at 4 a.m. on the following day, the shot firer at the surface felt a sudden rush of air accompanied by a loud noise and called to the men about the surface to get away at once, while at the same moment a column of black dust and carbonic acid rose through the pit to about 120 ft. above the surface, covering the surrounding buildings and rendering the air irrespirable for about 200 yards in every direction. The rush of gas lasted for about 1½ hours through both pits and the fan outlet. At the pit bank the deposit of coal dust was nearly 10 ft. thick, and 25 yd. away it reached nearly 3½ ft. on the roof and floor of the engine house, the ground and trees over an area of 50 acres to 60 acres being thickly covered. Three men who neglected the fireman's warning were suffocated by the gas and were found buried under the coal dust, one in the open air and the others on the engine-house floor. Many cases of incipient suffocation were found among the inhabitants of the houses near the shaft top, and a considerable area remained inaccessible for about 2 hours, while poultry, birds and pigs were killed by the gas up to more than half a mile away. The efflux of carbonic acid continued for about 12 hours.

In cleaning up, 523 tons of coal in fine dust were collected at the surface and about 500 tons more were estimated to have been distributed by the wind over the surrounding country. The bottom of the pit was filled up to a hight of 49 m., and from the lower filling place at 208 m., it was projected into the workings to a distance of 140 m. from the pit eye. The coal so distributed through the workings amounted to 1774 tons, and it is estimated that the total quantity blown out exceeded 4000 tons. The seam from which the gas proceeded has since been found to be of the unusual thickness of 18 m., and nearly flat. It contains 6½ to 9½ per cent. of volatile constituents and in the sinking showed irregular alternations of hard and very fragile coal, apparently due to a fault passing through at that point. The discovery has been a surprise, as none of the coals of the district had hitherto been known to be more than 10 m. thick.

The Coalfields of Canada*

By Phillips Thompson

The great influx of population during recent years into the prairie provinces of Canada, large areas of which are entirely destitute of timber, renders the fuel question one of grave importance to the future of that region. It is natural, therefore, that considerable attention should be directed toward ascertaining how far the coal resources of the middle portion of Canada are capable of supplying the steadily increasing demands of a growing population. This report aims at presenting a concise statement of the area and probable contents of the coalfields of the provinces named, together with other information showing the condition and prospects of the coal-mining industry, with analyses showing the quality and value of the different coals, as compared with American and other fuels. The problem of forming an estimate of the coal content of the various areas is admittedly a difficult one, and the writer intimates that the maximum value deduced from data at present available has been given. The minimum can be arrived at only after years of prospecting. Considerably closer estimates can be made in the case of the small rich areas exposed in the mountains, than in the flat-lying measures where the exposures are at great distances apart, with few drill holes to prove the intervening portions. A low estimate of the general content is, therefore, to be placed on the areas outside of the mountains.

*This article is an abstract of report on "Coalfields of Western Canada," by D. B. Dowling, of the Canadian Geological Survey.

Coal Deposits of Alberta

The province of Alberta is liberally supplied with coal areas. The western border of the southern part consists of several ranges of mountains formed generally of rocks which were originally the floor on which the coal formations were laid down. The elevation of the coal formations subjected them to greater denudations than the harder rocks beneath, consequently little of this material is left, but in the wider valleys remnants are found which from their superior quality and amount of coal form valuable coalfields. The structure of the eastern British Columbia areas is intimately related to that of the Alberta mountain area. Exposures are to be found in the Elk river valley, that generally known as the Crows Nest area containing 230 square miles of coal lands, estimated to contain 22,000,000,000 tons of bituminous coal. North of this on the upper waters of Elk river an additional area of 140 square miles has an estimated content of 14,000,000,000 tons. These, like the coals of the adjoining areas in Alberta, belong to the Kootanie formation. In the latter province they are generally exposed in narrow lands in the mountains, the principal of these areas being the Coleman, 45 square miles, estimated to contain 2,000,000,000 tons; Blairmore-Frank, 50 square miles, estimated content, 1,500,000,000 tons; Livingstone, 60 square miles, estimated content, 1,500,000,000 tons; and Cascade 40 square miles, estimated content, 1,600,000,000 tons. These coals are mainly bituminous with some anthracite. The coals of the foothills belonging to the Edmonton formation are partly lignites, but grade up to bituminous.

These areas, though but narrow bands, have a length of about 400 miles, and may have an exposed area of possibly about 2000 square miles with a total content of 11,000,000,000 tons. Further east a large area produces lignites, that in places are almost lignitic coals. The estimate for that portion of the formation between Bow river and Edmonton gives 10,800 square miles with 6 ft. of coal below it at workable depth, or a possible content of 60,000,000,000 tons.

Coals of the Belly River and Laramie Formations

The coals belonging to the Belly river formation grade generally between lignite and bituminous and are found over an enormous area lying east and south of the Edmonton formation and extending into the province of Saskatchewan. Of this area, portions of which are known to be unproductive or to contain only small

seams of inferior coal, 5000 miles are assumed as being valuable, which with coal of an estimated thickness of 4 ft. would furnish 13,000,000,000 tons, 10,000,000,000 tons being in Alberta and the remainder in Saskatchewan.

The coals of the Laramie formation are lignites. The Souris area in Saskatchewan, now being worked, is estimated to contain 2,000,000,000 tons and the remaining portion lying to the west, consisting of 4000 square miles, has possibilities up to about 13,000,000,000 tons.

Manitoba's coal resources are limited to the Turtle mountain area in the southern portion of the province, belonging to the Laramie formation and embracing 48 square miles which represents a possible total of 160,000,000 tons.

The total estimate for the three provinces and eastern British Columbia approximates 22,506 square miles and 143,490,000,000 tons of coal classified as follows: Anthracite, 400,000,000 tons; anthracitic and semi-anthracite, 860,000,000 tons; bituminous and some semi-anthracite, 43,070,000,000 tons; coal and lignitic coal, 21,000,000,000 tons; lignite, 78,160,000,000 tons. The report adduces figures to show that the coal consumption is increasing at a much more rapid rate than the population, so that it is evident that unless new mines are opened, the present plants will in a few years be taxed to their full capacity. Much of the need for domestic fuel is now being supplied from the lignite belt, but industrial and transportation requirements will demand coal in largely augmented quantities for power production, resulting in a great increase of the per capita consumption with additional population.

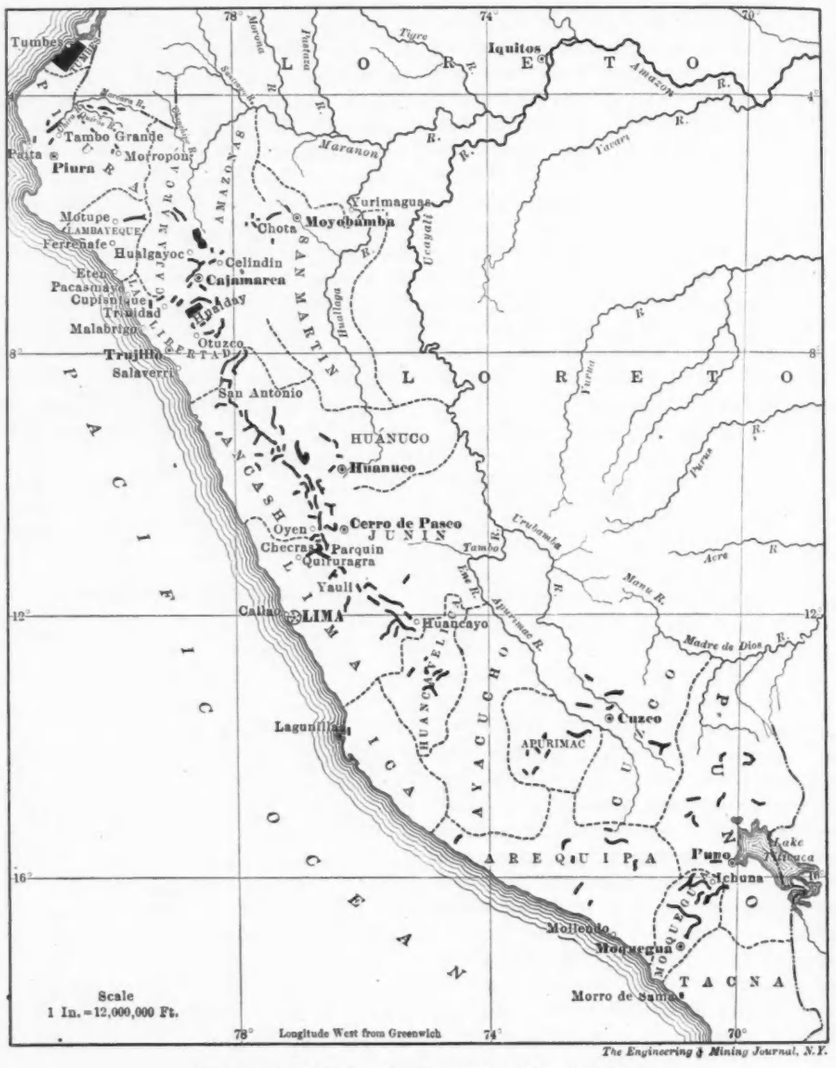
The Winter Meeting of the West Virginia Coal Mining Institute

The winter meeting of the West Virginia Coal Mining Institute was held at Huntington, W. Va., Dec. 7, 8 and 9, and was largely attended by coal-mining men from all parts of the State. A number of papers were read and discussed according to the program recently published, and a day was spent in visiting the mines of the United States Coal and Coke Company on the Guyan Valley road.

The following officers were elected: President, J. B. Hanford, Morgantown; vice-presidents, Neil Robinson, Joseph Virgin, Frank Haas, Paul Hardy; secretary and treasurer, E. B. Day; executive committee, John F. Healey, D. Towers, J. W. Heron and P. A. Grady. The papers that were read at the meeting will be published in whole or part in a succeeding issue of the JOURNAL.

Geographical Distribution of Coal in Peru

The map published herewith, supplementing the article on the coal deposits of Peru in the JOURNAL of Nov. 13, shows a wide distribution of the coal-bearing strata in this Andean region and suggests that the real extent of these coal deposits is not yet demonstrated. The map shows an interesting geological condition and



MAP SHOWING PRINCIPAL COALFIELDS OF PERU

justifies the claim of commercial importance which has been made for these Peruvian coal measures.

The Lewistown Coalfield, Montana*

A survey of the coal lands around Lewistown, Fergus county, Mont., was made in 1907 by W. R. Calvert, geologist of the United States Geological Survey, whose report has just been issued as Survey Bulletin 390.

*Report by the United States Geological Survey.

The Lewistown coalfield covers about 1500 square miles, the greater part of which lies in the Judith basin, a name applied to the principal drainage basin of Judith river. The boundaries fixed for the field are land lines, the western boundary adjoining directly the eastern limit of the Great Falls coalfield, which has already been made the subject of a report issued by the Survey.

Mr. Calvert describes the geography and geology of the field, the coal beds and their present commercial development, and the character of the coals, giving chemical analyses.

PROSPECTS OF FURTHER DEVELOPMENT

Under the heading "Future Development," after stating certain conditions that are unfavorable to an early development of the coal resources of the field, Mr. Calvert writes:

"In spite of the foregoing considerations, however, there is every probability that there will be a constant and increasing local demand for the coal of the Lewistown field. Judith basin has developed

remarkably within the last few years and now contains a considerable agricultural population. Lewistown is a thriving business center, and other towns within the field are growing rapidly. Another factor which will add to the local demand for coal is the depletion of timber in the field. The Little Belt, Judith and Moccasin mountains are now almost bare, and the only remaining sources of timber are the Big Snowy mountains and the district in the vicinity of Rock creek.

"In regard to the possibility of future demands from outside the field for coal, there is a rather important factor which should be taken into consideration. The Great Falls and the Lewistown fields are the only large areas in the central part of the State which contain a bituminous coal. The coal in the eastern part of the State is a lignite, and that of the Bull mountain and other fields to the south is probably subbituminous. This latter class of coal, while it is a fair grade of fuel for stationary engines, is not so well adapted for locomotives, and in addition it does not stock well. On the contrary, the coal of the Lewistown field both stocks fairly well and is an excellent locomotive fuel. Because of these qualities it seems probable that if in the future an outlet is furnished for the coal it will be used to a greater degree by the railroads of the State in preference to fuel of a lower grade."

Lessons Taught by the Cherry Mine Disaster

SPECIAL CORRESPONDENCE

A number of changes in the Illinois mining statutes, shown to be necessary from the Cherry mine disaster, were suggested by George S. Rice, head of the mine accident division of the United States Geological Survey, in a lecture before the Western Society of Engineers, Chicago, Dec. 1.

Mr. Rice represented the Government in the rescue work at Cherry and was one of those who donned helmets and helped explore the St. Paul mine.

"What lessons are we to draw from this and other like disasters?" said Mr. Rice at the close of his lecture.

"First, the danger of having combustible material taken down wood-lined shafts and into timbered passageways.

"Second, the menace of having the approaches and the exits themselves of combustible material."

"Third, the danger of reversing a fan when those above do not know all the conditions underground at the moment of reversal. This may not have been a matter of consequence in the present instance, but the dangers are brought to notice.

"Fourth, the importance of having ample fire-fighting equipment and systematic drilling.

UNDERGROUND RESCUE CHAMBERS

"Fifth, that escape facilities suitable for a mine with 100 underground workers may not be suitable for 500 or 600 workers. The depth of the working should also be taken into account. Stairway exits which are required by the present Illinois law, while suitable for shallow seams, may not be so for deeper seams, except as an auxiliary means.

"Sixth, that fireproof underground rescue chambers, supplied with food, water, and means of communication to the surface, preferably with an open drill hole, would be of inestimable value. Such chambers are used in some of the German mines, equipped also with oxygen breathing apparatus.

"Safety provisions cost money. With the prevailing drastic competition in the mining industry, such expenditures would force many operators out of business. But the public, I believe, would be willing to pay for them.

"The maintenance of the widows and orphans should be as much a part of the cost of production of coal as the payment of wages and the means of living. A part of the cost should be compulsory accident insurance made compulsory by the laws of the State."

During the lecture Mr. Rice made a general and sharp criticism of coal mining and the laws pertaining thereto in the United States, comparing them with those of European countries. "The death records for the United States during the last 15 years for the mining industry are remarkable," he declared. "No other industry shows such an increasing death rate. The death rate in 1895 was 2.67 to every 1000 men engaged. In 1908 the death rate was about 3.50 per thousand. This is different abroad. The death rate for Belgium last year was 0.91 per thousand, and our figures show the United States to be where Belgium was eighty years ago."

A Primer on Explosives

The U. S. Geological Survey is about to issue a "Primer on Explosives" as an aid to the coal miner in particular and also to all who handle explosives. The misuse of black powder and other explosives is sometimes considered the least important of the causes of mine accidents; but its importance is much greater than the statistics indicate, for the reason that this misuse of explosives may itself be the cause of many of the mine fires, gas or dust explosions or falls of roof, and thus be responsible for a death roll often credited to other causes.

The use of explosives is increasing both in quantity and in the variety of purposes to which they are applied. There is no such thing as a safe or safety explosive when in the hands of a careless or ignorant person. This statement is true whether considered in connection with the transportation or use of these explosives in mining. The aim of this book has been to tell what explosives are and how they should be handled with a view toward greater safety, and to do this in language free from unnecessary technicalities. It has been prepared by Charles E. Munroe, explosives expert, and Clarence Hall, explosives engineer, of the technologic branch of the U. S. Geological Survey. It has been revised in the light of suggestions made by the mining engineers associated with the survey, by several mine managers, by the experts associated with the manufacture of explosives and by B. W. Dunn, chief of the Bureau for the Safe Transportation of Explosives.

Much of the information has been obtained from experiments conducted at the mine accidents station of the survey at Pittsburg, authorized by Congress, May, 1908, for investigations as to the "causes of mine explosions." These investigations have shown the recent development of a new type of quick-flame explosives designated as permissible explosives, which can be used with greater safety than black powder in mines, where gas or inflammable dust exists under conditions indicative of danger, for the reason that the flame from the explosion of black powder lasts from 1000 to 4000 times as long as the flame from those newer explosives and is, therefore, more likely to ignite the gas or dust in these mines.

Lists of permissible explosives were issued by the survey on May 15 and Oct. 1, 1909—the latter list containing the names of 31 explosives—and with these lists is to be found a statement of the conditions under which these explosives have been selected from a larger number presented for examination. There are also in course of publication and soon to be issued, bulletins dealing with other phases of the subject, such as methods and results of using permissible explosives in coal-mining operations, the results of tests of explosives and concerning the dust problem in coal mining.

It may never be possible under conditions such as exist today to prevent mine accidents. Little may be accomplished in that direction by either the operators or miners working alone, but experience in all countries shows that through the cooperation of the two these accidents may be greatly reduced. This will require wise laws and regulations based on fact and experience and the strictest possible discipline.

The special purpose of the primer is to prevent the improper use of explosives in mining, and thus lessen the number of accidents. This purpose is to be most certainly accomplished through the use of the best and safest explosives, handling and firing these explosives in the safest manner by carefully selected and trained men and the strict and competent oversight of these men.

Mining Coal in Spitzbergen

By Tony Callot*

Coal is found in Spitzbergen in the largest fjord of the western coast, called ice fjord. This fjord is located at over 78 deg. N. and includes several bays or smaller fjords such as Green harbor, Advent bay, Sassen bay, North fjord and Dickson bay. Coal is extracted at Green harbor and at Advent bay. At the former place it is used only for a whale-fishing station, where whales are mechanically cut up by special steam-driven appliances. The mine is therefore worked on a very small scale for the local need.

At Advent bay two mines were opened, one by the Spitzbergen Coal Trading Company, Ltd., and the other by the Arctic Coal Company, an American-Norwegian enterprise. The first is now closed and the so-called Advent City was transported on the other side of the bay where the mine of the Arctic Coal Company is now at full work.

Advent City is in a narrow valley and consists of some 12 dwellings built after the Norwegian fashion. Water is brought to the city through a 1-in. pipe which crosses the valley and branches by places to a number of casks for the convenience of the inhabitants, some of whom winter there. The climate is rude, reaching often as low as 35 deg. C. below the freezing point in winter. In August, at the time of my visit there, I noted 11 deg. C. of heat in sunshine.

Description of the Mine

The mine is on the hillside at some 1000 ft. above sea level. It consists of one horizontal seam, 1 m. thick, with a good sandstone roof. The method of working is most simple. A main gallery about 7 ft wide by 6 ft. high is opened in the seam and at regular intervals of 25 m., perpendicular drifts are cut out. The first 50 m. of the main gallery is lined with nicely crystallized ice, which by its white and bright appearance gives an uncommon impression in entering a coal seam.

A double narrow track 24 in. wide is laid in the main gallery and branches extend into the drifts where single track is used. Haulage is done by horses. Eighty workmen are at work there, using picks and hand drills. Additional machinery is to be installed when it is expected to produce from 500 to 600 tons of coal daily. The men are paid 6 kroners a day (about $1.48).

Shipping Coal

Near the mouth of the mine, cars are tipped into an inclined chute which feeds a bin about 12m. long, fitted with 10 doors. From here the coal is delivered into the cars of a Bleichert aërial cableway, which descends by gravity to the pier. A powerful brake prevents the cars reaching too great a velocity. The empty cars are elevated by the loaded ones. Coal is either stored or delivered at once to the cargo-boats. The store is on the ground in front of the pier whence it is reclaimed by hand and cars which run down an incline to the pier.

Some Spitzbergen coal was supplied last year to the Norwegian State Railway; 2000 tons were shipped to Trondhjem and 4000 to Narvick, which is the terminus in Norway of the most northerly railway in the world. This line connects the iron mine of Gelivara, Sweden, with the Glacial ocean. Forty men wintered in Advent City last year and mined 2000 tons of coal during that time.

In conclusion, I would mention that Spitzbergen, being *terra nullius*, is open to any prospector who desires to become a mine owner. He will not have to buy any ground or pay any tax. Everything is free. The only living things are the reindeers, birds and fish, while rocks, ice and snow constitute the entire scenery of the country.

*Engineer, 16 Boulevard Malesherbes, Paris, France.

Mining by the Tunnel and Heading System

The large pyrites orebody at the Arminius mine at Mineral, Va., is mined by a modification of the underhand stoping method known as the tunnel and heading system. The orebody varies in width from 8 to 60 ft. and dips at an angle of about 60 deg. The walls are slate which holds well so that practically no timber is used in the stopes.

Levels are run at intervals varying from 50 to 100 ft. and the ore drifted on with tunnels carrying a 10-ft. face. From these drifts the procedure is to drive a raise inclined at about 45 deg. to the level above. Leaving a pillar of about 12 ft. below the upper level, a heading is driven below the drift of the upper level. From this heading the ore is then worked back and down the raise in benches varying from 4 to 6 ft. in hight. A pillar of about 12 ft. is also left above the lower level.

COAL-SHIPPING STATION AT ADVENT BAY

SHOWING CHUTE TO THE BINS OF THE AERIAL ROPEWAY

ADVENT CITY LIES IN THE VALLEY BELOW

At convenient intervals, usually about 25 ft. auxiliary raises are put up from the main haulage way to connect with the stope above and aid in drawing out the ore. These raises are usually driven on the footwall, i.e., on the dip, but this is not necessarily the case. Pillars and legs of ore are left where necessary.

By this system only from ½ to ⅔ of the ore is recovered; the pillars are, however, to be drawn later and to this end a new shaft is being sunk in the footwall country about 50 ft. from the orebody. From this shaft drifting will be done and crosscuts run to tap the ore.

This method of mining is generally practised in the Louisa County pyrites mines. Its disadvantages are that all ore must be shoveled from the floor into the tram cars and a large percentage of the ore must be left to protect the levels and hold the stopes open. In the Arminius mine 250 lb. Ingersoll-Sergeant drills are used on tripods in all work, driving and stoping. A drill crew consists of a machine runner, tail man and nipper.

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Illustrated.

The "Guggenheim" Coppers

It was announced, Dec. 17, that the Utah Copper Company would call a shareholders' meeting on Jan. 6 to authorize increase in capital stock from 750,000 to 2,500,000 shares, a portion of the increase to be used to acquire Boston Consolidated at ratio of 2½ : 1 and Nevada Consolidated at 2¼ : 1 (providing that a majority of Nevada stock is thus exchanged), and a portion to provide funds to increase the Utah milling capacity to 12,000 tons per day and the Boston milling capacity to 5000. This plan is bitterly resisted by important interests in Nevada Consolidated, and an inquiry as to why such a plan should be contemplated is in order.

It has been evident for a long time that there is something wrong in the Utah Copper Company. Without doubt it possesses a great and valuable mine, but as we have previously remarked it has failed to come up to the expectations, particularly as to cost of production. The erratic manner in which the cost as reported quarterly by the company itself has been fluctuating is indicative of something askew that the explanations of the officers do not satisfactorily account for. It is to be noted, moreover, that while the company has been making elaborate quarterly reports, with apparent frankness, it has avoided stating an essential part of the fundamental data, viz., the tonnage of ore milled.

Recently our Salt Lake contemporary, *Mines and Methods,* has specificallly charged that the officers of the Utah Copper Company conduct their bookkeeping in such a way as to conceal the real cost of mining, particularly as to the accounting of stripping overburden; that in order to maintain production of copper at the promised rate they have had to overcrowd the mills; and that it is doubtful if the estimated great ore reserves can be actually extracted by the present method of mining at anything like the profit heretofore reckoned. There is a strong suspicion that there is a great deal of truth in the main part of the charges of *Mines and Methods.* If there be not the company can easily disprove them by publishing the data that should have been given in its reports to enable a careful and impartial analysis. The stockholders of the company should demand the publication of that data.

The Boston Consolidated awoke to the realization of disappointed hopes about a year ago and manfully recognized its mistakes, which involved a complete change in its method of mining. It was found that the ore that was thought to average 36 lb. copper per ton in reality had only 30 lb. and that the probable cost of production would be about 10½c. per lb. of copper, which is materially higher than was previously reckoned. However, the work of the mill came up to expectations, in so far as extraction is concerned, wherefore a yield of about 20 lb. per ton is realized.

The Utah Copper Company was absolutely confident that the bulk of its ore averaged 40 lb. copper per ton. We believe that it is actually extracting about 20 lb. It is well known that the mill has fallen below expectations in point of extraction. We imagine that the ore as mined is less good than was figured, just as in the case of Boston, and probably averages about 35 lb. per ton. The process of milling evidently has defects that it has not yet been possible to correct and to compensate for this and the inferiority in grade of the ore it has been necessary to rush through an increased quantity of ore. In order to produce at the rate of 60,000,000 lb. copper per annum, the company has apparently been compelled to mill nearly 3,000,000 tons of ore per annum, at which rate the estimated reserve of 65,000,000 tons of the better grade of ore will last but little more than 20 years. We doubt if it be safe to reckon more than 20 years' life, in spite of the marvelously superior estimates, and on that basis the value of the stock should be computed upon a 10-per cent. return. If we accept the estimate of 8.5c. as cost of production and 13.5 as a probable average realization, the average annual profit would be $3,000,000, or about $4 per share, which would indicate a value of $40 (? ?). The queries indicate grave doubt as to ability to produce at 8.5c. That figure may be attained by increasing the milling capacity, as now proposed, and raising the mill extraction to 70 per cent. This increase is the proper thing to do, but in undertaking to reckon what may be its economic result we are confronted always by doubt, inspired by the past record, as to the data offered for estimates.

As to the proposed absorption of Boston Consolidated it is clearly evident

that Utah must take it in, else a large part of the ore in the steam-shovel section of its mine will be unavailable; also the acquisition of Boston is desirable to ameliorate dumping difficulties. With respect to Boston Consolidated the glamor was largely removed by Mr. Jennings' report. It may be reckoned as possessing 28,000,000 tons of ore yielding 20 lb. per ton at a cost of about 10.5c., and as at present equipped can produce approximately 20,000,000 lb. per annum at a profit of about $600,000, or 77.4c. per share, indicating an actual value of about $9 per share on 30 years of life. As in the case of Utah, the value of Boston will be increased by enlargement of capacity, the plan being to raise this to 5000 tons per day from the present 2750, and in view of the frankness that has always characterized the Boston management we feel that the data for reckoning the benefit of increased capacity are reasonably reliable. We are inclined to think that the relative value of Boston and Utah shares is probably somewhere between 4 : 1 and 2½ : 1 and that in agreeing upon the latter ratio the Utah is conceding something out of its necessities.

The combination of these two companies is quite logical, but when we come to the project of taking in Nevada Consolidated, the scheme becomes wide open to criticism and the feeling is inevitable that one more trick is being played upon that distinguished enterprise. Nevada Consolidated is the one of the porphyry mines, come to the productive stage, about which there have been no disappointments. In almost all particulars have the preliminary engineering estimates been equaled or bettered. Consequently it is an enterprise in which the profession takes a special pride. Of the three operating porphyry mines it has the best grade of ore, the easiest mining and milling, and a producing cost far below the others. In milling about 2,100,000 tons per annum and obtaining a yield of 30 lb. per ton at a cost that may be conservatively put at 7c. per lb. (at present materially lower), its earning capacity is easily $4,000,000 per annum, or $2 per share. Although its ore reserves now measured indicate less than 20 years' life we feel rather more safe in anticipating that period than we do in the case of Utah and are inclined to value Nevada shares at $20 +. We should not even be disposed to dispute a claim of $25 as the probable intrinsic value in view of the possibilities that the company has in additional ore reserves, in its possession of the Steptoe smeltery, its chances for development of custom smelting business, and its great asset in the Nevada Northern railroad, which claims tribute from the whole Ely district and will shortly become a link in a transcontinental line. Obviously any such ratio as 2¼ Nevada shares for one of Utah is ridiculously unfair, as important interests in the Nevada company claim. They will doubtless contest this part of the combination project as they promise to do.

But why should Nevada Consolidated go into any such combination on any terms? It is an absolutely self-contained enterprise and has nothing to gain in economy of management or any other respect. If the union of Utah and Boston will result in increased economy, as doubtless it will, and appears to be an attractive investment, the Nevada stockholders can subscribe for the new stock along with the general public and without any fear that they are being flim-flammed in the exchange of their own valuable property. It looks as if under the present project Nevada is to be put in as a "sweetener." Why the Guggenheims should want to perpetrate this deal may remain a mystery for a while, but even if they can carry it through we advise minority stockholders to reflect if they will not best keep their present property and at the worst let Nevada Consolidated stand in the same position as Anaconda does in Amalgamated.

E. S. Mendels, agent for the New York Curb market, has inaugurated a new reform, effective Jan. 1, by announcing that he will refuse to accept incorporated brokerage houses as subscribers. Such concerns as continue to do business will be obliged to operate through some representative, who will be held personally responsible for all liabilities. This is in line with the practice of the New York Stock Exchange, wherein no corporations are allowed to do business. Mr. Mendels, who is in charge of Curb affairs by common consent, has accomplished a great deal of important work in putting that open market upon a substantial and reputable basis, and is to be congratulated upon his new reform which strikes at a serious evil.

We do not take much stock in the talk of a general curtailment of copper production by common consent. Some concerns may have made up their minds to refrain from further increase until conditions become more propitious, but there are too many that cannot restrict without increasing their cost of production too much to make the plan agreeable. Where for example would the porphyry mines stand, which are fundamentally dependant upon a large tonnage? The present scheme to increase the capacity of the two mills at Garfield does not look much like any idea of restricting output in that quarter.

Some good old-fashioned mining companies used to set aside their profits until the principal was reimbursed before they began to pay dividends. Perhaps there are some that still do this. When a smeltery or any new construction is required they discontinue dividends until it is paid for. Under this system there is never any doubt that what may appear as profit on paper may not be real profit. Of course this would not suit the requirements of modern financiers. However, these old-fashioned companies were working their mines as mines and had no eye to the stock market.

We are inclined to think that the much discussed copper consolidation—meaning the combination of Cole & Ryan, Amalgamated, and Guggenheim interests—will fail of consummation, although the project has not yet been abandoned. It might have been effected if it had been sprung when contemplated but the Standard Oil decision checked that. The psychologic moment has been missed, and the deferred plans are likely to sink under the weight of criticism and ridicule, the temper of the public being unfavorable to combinations that aim to boost prices.

Congress is once more wrestling with the bureau of mines bill. A strong attempt is to be made to consummate this at the present session, but there appears to be strong opposition. We think we are correct in saying that the mining engineers of the country do not see the use of such a bureau and consequently are rather opposed to having it.

The annual statistical number of the JOURNAL, covering the year 1909, will be the issue of Jan. 8, 1910.

Discussion

Coal-mine Safeguards

Apropos of the recent disaster at the St. Paul mine, Cherry, Ill., it has frequently occurred to me that someone is very lax in providing safeguards to protect the lives of the miners in the various districts. These provisions should reduce the fatalities to the minimum, if not wholly prevent the loss of life.

It has been the record of every disaster of this character that a large number of miners have been entombed and, while they were not killed outright from the force of the explosion or fire, they died of starvation or from the deadly blackdamp. Had these survivors been furnished with a pure-air supply, food and water, there is no question but what hundreds of lives might have been saved in the last few years.

At the Harwick mine explosion in Pennsylvania, a large number of miners literally starved to death, and the same was true at Monongah, W. Va., where between 350 and 450 miners lost their lives—and now the Cherry disaster, to say nothing of the dozens of instances where anywhere from one to twelve men have been killed! In view of the inexpensive method which might be employed in safeguarding the various mines it would seem that our law makers should pass such measures as would compel the mine operators to adopt such a precaution.

I noted an article in one of the mining papers recently where the editor advances the theory of installing telephones in mines so that the emtombed miners might get into communication with the outside world and be able to give them their exact condition, the condition of the mine, etc. This would be some safeguard and guide for the rescuers, providing the telephones were installed in such shape as to prevent the explosion from destroying the wires, but the ideal plan would be to sink bore holes from the surface at stated intervals, running along the main entries and tapping the main stations in the mine. These bore holes should be cased with iron pipe from top to bottom, and be of sufficient size so that in case of accident they could be used for supplying various sections of the mine with pure-air supply, food, water and communication with the entombed miners.

It would hardly be possible for an explosion to destroy a bore hole as these explosions do not usually occur in the main entries of the mines. They are usually in some part of the mine that has been abandoned and with no outlet for the gas which accumulates. This is largely responsible for the explosions that take place. If bore holes were sunk into the old workings they would provide an outlet for the dangerous gases and blackdamp.

Had this provision been installed in the Cherry mine as well as the others, and fresh air furnished to the miners, a large number of lives could have been saved. These disasters fall on a class of people who are dependent on their daily labor for the livelihood of their families, and the loss of the bread winner under these circumstances produces deplorable conditions which cannot be imagined by the class of people who are in better circumstances financially.

I believe that the men who will advocate and push to a conclusion a measure of this kind will have done something that will cause their names to be remembered for all time. The idea is not original with me, as I have seen this plan used in ventilating mines. In mines where they could not get a pure-air supply to the face of the entries which they are driving by the ordinary means of a fan, they drilled holes ahead of the entry and when these holes were tapped they caused a great current of air to flow through the entries which carried out the smoke, gas, etc., back and up through the hoisting shafts.

W. T. Kershner.

Washington C. H., Ohio, Dec. 2, 1909.

[The Journal has repeatedly emphasized the usefulness and desirability of holes from the surface as recommended by our correspondent.—Editor.]

Questions and Answers

Value of Pumice

Please inform me as to the commercial value of punice. • D. P. L.

The current New York quotations on pumice are given in the table published monthly in the Journal. Quotations as given in the Dec. 4 issue are: American powdered, 100 lb., $1.60@2; Italian powdered, 1⅜@1¾c per lb.; lump 5@30c. per lb. T. Van Amringe, 241 Water street, New York City, is a dealer in this material.

Talc

Is there a market in America for finely powdered steatite of the best quality, such as is valued in England at £5 per ton? What firms buy this material?

B. & Co.

There is a market in the United States for limited quantities of high-grade ground talc or steatite, of which about 10,000 tons are annually imported, mainly from France and Italy. Considerable crude talc is now imported and ground in the United States; the crude talc is admitted free of duty, the ground product being subject to an import tariff of 20 per cent. ad valorem. Of ordinary grades there is an abundant domestic supply and only ground talc of superior quality can be imported. The market for talc is exceedingly varied, depending upon the physical qualities demanded by the various trades; see The Mineral Industry, Vol. XVII. The leading jobbers are Hammill & Gillespie, 240 Front street, New York, and L. A. Salomon & Bro., 216 Pearl street, New York. Colgate & Co., 55 John street, New York, and the Gerhard Mennen Chemical Company, 42 Orange street, Newark, N. J., are large users of ground talc in toilet powders.

New Publications

Summary of the Surface Geology of Michigan. By Alfred C. Lane. Published by the Board of Geological Survey as a part of the Report for 1907.

Tables and Diagrams of the Thermal Properties of Saturated and Superheated Steam. By Lionel S. Marks and Harvey N. Davis. Longmans, Green & Co.

Die Brennofen fuer Tonwaren, Kalk, Magnesit, Zement und Dergl, mit Besonderer Berucksichtigung der Gasbrennofen. By Ernst Schmatolla. Dr. Max Janecke.

Report on the Examination of Some Iron Ore Deposits in the Districts of Thunder Bay and Rainy River, Province of Ontario. By F. Hille. Government Printing Bureau.

The Rise and Progress of the British Explosives Industry. Published under the auspices of the Seventh International Congress of Applied Chemistry by its Explosive Section. $5.25. Whittaker & Co.

The Mining and Quarry Industry of New York State: Report of Operations and Production During 1908. New York State Museum, Bull. No. 132. By D. H. Newland. University of the State of New York.

A Geological Reconnaissance in Northern Idaho and Northwestern Montana, by F. C. Calkins; with Notes on the Economic Geology, by D. F. Donald. U. S. Geological Survey. Bulletin No. 384. Government Printing Office.

The report of the Select Standing Committee of the Canadian House of Commons on mines and minerals has been issued. The proceedings were principally concerned with the granting of mineral rights, the evidence of a number of delegates of the Canadian Mining Institute being taken. The following recommendations were made by the committee: (1) That there should be assigned to the Department of Mines the administration of mines, including the issue of title thereto, and of all mining laws; (2) consolidation of all the laws relating to mines under federal control; (3) re-acquisition by the Crown of mining rights granted in patents of land.

Rapid Method for Determining Copper in Slags

By F. D. Aller*

Many methods for the determination of small amounts of copper in slags have been published. Practically all of these provide for the dehydration and separation of the silica by filtration. If, however, the chilled sample is dissolved in rather dilute acid, preferably sulphuric, and maintained at the boiling point in a high state of dilution, the silicates remain soluble while the dissolved copper may be precipitated by any of the common methods, preferably on aluminum, and the precipitated copper, together with the undissolved copper, may be separated by decantation and determined by the iodide, cyanide or electrolytic method. I introduced the following rapid method in the Establecimiento de Playa Blanca, Antofagasta, Chile, in 1900, and it has since been used at various copper smelteries in Chile.

Place 5 grams of the thoroughly chilled and finely powdered sample in a large beaker of at least 600 c.c. capacity and cover with 200 to 400 c.c. of water; bring to boiling and treat while stirring with 10 to 15 c.c. of sulphuric acid previously diluted in cold water. The entire slag goes into immediate solution with the exception of matte, lead sulphate and carbon; the latter forms a slight scum on the surface of the solution, but in no manner interferes with the accuracy of the determination. Five or six large strips of sheet aluminum are now placed in the solution, which is then diluted up to a bulk of about 500 c.c. and gently boiled for about twenty minutes, when all copper should be precipitated. The solution and precipitate are now poured into another beaker, leaving behind the aluminum which is washed with a jet of water in order to free it from adhering particles of copper. The washings are added to the solution, and it is allowed to settle for about five minutes and then decanted; about 200 c.c. of hot water are added to the precipitate, which is again allowed to settle and the clear solution decanted.

The precipitated copper (with undecomposed matte and any shot copper) is now dissolved in a little nitric acid and the copper determined by titration with cyanide or iodide of potassium in the customary way; or the nitric acid is neutralized with ammonia, 2c.c. of sulphuric acid added and the copper deposited on a platinum cylinder by electricity. A single determination should require not more than thirty-five minutes, and five or six can be made in less than an hour. If the titrating solutions are of such a strength that 1 c.c. is equivalent to 0.005 gram of copper, then each 0.1 c.c. corresponds to 0.01 per cent., which is delicate enough for practical purposes.

For the rapid determination of lead, the slag is dissolved as before, diluted to a large volume with hot water, allowed to settle ten minutes, decanted once, the settled lead sulphate (carrying also a little calcium sulphate) is dissolved in nitric and sulphuric acid, boiled to copious white fumes, diluted with cold water, boiled and filtered (practically all of the calcium is left in the filtrate, thereby not scoring as lead in the final titration). The filter containing all the lead as sulphate is now dissolved in ammonium acetate and titrated with solution of ammonium molybdate.

*Agent, American Smelting and Refining Company, Antofagasta, Chile.

System Gone Mad

By David Wallace.

This is an age of short-cuts, abbreviated formulas, concentrated thought and systemized accounts, so much so that life for a modern man of business is becoming one long nightmare of impending doom. Is the "game worth the candle?" Mining companies have not escaped the prevailing craze, for elaborate forms, index cards and tabulated charts appear now to be the rule; indeed, one may well exclaim, "It is system gone mad!"

With many companies and small properties it is simply waste of time, energy and money to install a so-called system of accounts, for, if the mining engineer in charge complies with an auditor's requirements and stays in the office to work up a beautiful set of typewritten monthly statements, it will be at the expense of his more important duties of looking for ore and extracting same. On the other hand, if one of these cleverly devised, automatic-check inhumanizing schemes is turned over to a soulless office staff, the whole business may become a complete failure—killed by red tape.

I have in mind a high-sounding, steel-engraved letter press British Mining Company, Limited, working some properties in Spanish America, with mines, mill, lixiviation and cyanide plant. The general manager, a thorough gentleman and competent engineer, was a stickler for detailed statements (though it was not this company which insisted on the staff dining in evening dress). Printed forms were supplied to foremen, surveyors, contractors, hoistmen, mechanics, millmen, assayers, storekeepers, etc., from which the clerical force in the office filled out another complicated set of cost sheets—till it seemed, to an outsider, that the sole object of the employees, from shift boss to general manager, was to make out and file reports.

For several months the major portion of the manager's monthly statements of operations to the board of directors was taken up with explanatory reasons for not showing a profit. Eventually, the resignation of the general manager was called for and his place taken by a rough-and-ready, though none the less practical, superintendent, whose first procedure was to abolish nearly all the red-tape mining and metallurgical forms, telling the men to attend strictly to their proper work and not take up the company's time with pen and pencil.

The new man promised to obtain profits if allowed a free hand and this, too, while making improvements. His first monthly report was laconic:

Value of ore produced and treated $.....
Total expenditure $.....
Net profit $.....

Further comment is needless.

Minerals Separation, Limited

Special Correspondence

The report of the directors of the Minerals Separation, Ltd., of London, for the period ending Dec. 31, 1908, states that a considerable revenue has been earned in royalties from the plants erected at Broken Hill, N. S. W., and that remunerative results are also being obtained from the plant erected by the company on joint account with others for the treatment of purchased tailings.

The Sulphide Corporation, Ltd., of Broken Hill, treated 251,123 tons under license, of which 162,292 tons were crude-ore tailings direct from the company's wet mill, and 81,831 tons were old dump tailings. The Minerals Separation company's own plant treated 167,371 tons of tailings at a cost of 7.92s. per ton, all expenditure being charged to working account and none to capital account.

During the first nine months of the present year 149,505 tons of tailings were treated on joint account by this process, producing 53,208 tons of concentrates averaging 13.6 oz. silver, 8.8 per cent. lead and 46.4 per cent. zinc, at a cost of 7.383s. per ton. During the same period the Sulphide Corporation treated 143.698 tons of tailings.

In addition to the litigation of the Minerals Separation with the British Ore Concentration Syndicate and A. Stanley Elmore, the decision regarding which was noted in the Journal of Dec. 4, 1909, a third action in which the company was engaged, namely, that brought against the Ore Concentration company (1905), was dropped "for reasons of policy irrespective of any legal consideration involved in the action."

As regards the degree of concentration obtained it was announced at the general meeting that for the five months ended Sept. 30. 1909, the zinc percentage in the concentrates had gone up to 47 per cent. The lead is not taken from the concentrate at present. In this respect the company appears to be behind some of the other processes at work on Broken Hill silver-lead-zinc ores.

Details of Practical Mining

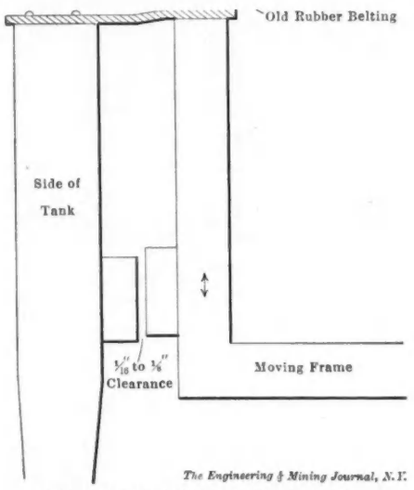
Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

REPORTS FROM EXPERIENCE

Readers of the JOURNAL are invited to contribute to this department. Articles should be brief, thoroughly practical, and preferably illustrated by drawings or sketches. Our draftsmen will prepare properly any kind of a pencil sketch that is intelligible. Something that is an old story in one district may be quite unknown in another. Articles accepted and published are suitably paid for.

Saving Wear on Hancock Jigs

A great deal of unnecessary wear is caused and trouble experienced by having feed fall into the space between the moving frame and the tank of Hancock jigs. This is easily prevented by attaching old



BELTING ATTACHED TO KEEP OUT FEED

pieces of rubber belting to the top of the tank, as shown in the accompanying sketch. The rubber being pliable causes practically no resistance to the movement of the frame and at the same time the space between the moving frame and tank is closed to any feed material which may splash over.

Abandoned Shafts and Open Cuts

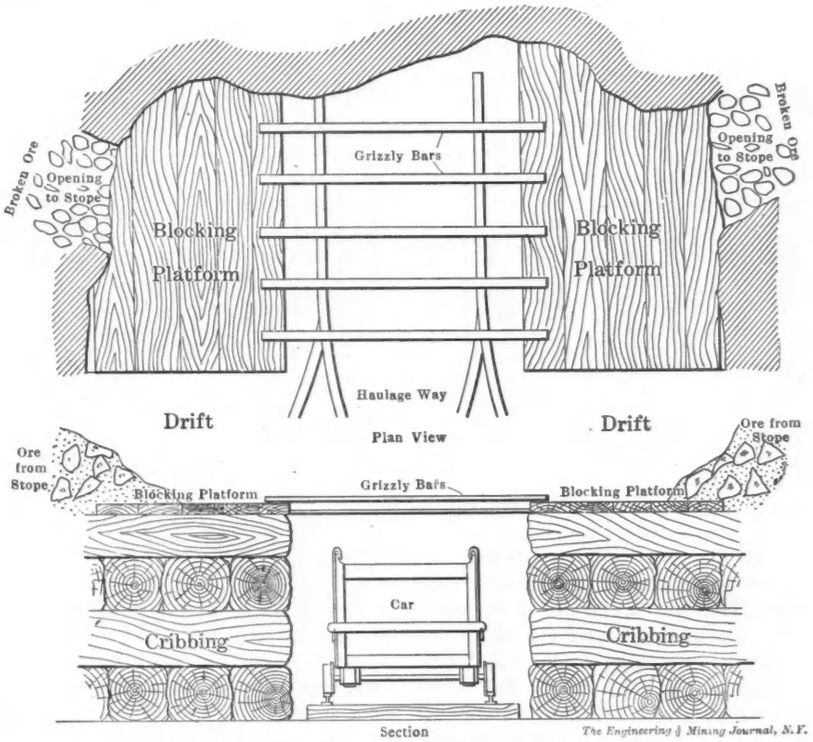
Abandoned shafts and open cuts should be securely covered or fenced to prevent accidents due to persons falling into them. This, however, is not such a simple matter as one would at first suppose. In many cases this has been done, and when the mine inspector makes his rounds, all is in good shape. Perhaps on his next trip these same openings will be unprotected, due to the fact that someone simply steals the material with which the shaft has been covered or the open pit is fenced.

Only recently in South Africa an old shaft was covered with timbers too heavy to move, and they were actually chopped in pieces in order that they might be carried away. In another case a wire netting had been placed around an open pit and some one had deliberately taken the wire down and carried it away.

In practically every mining camp one comes across abandoned shafts that are not covered in any manner. Too much care cannot be taken to make these places safe. In the vicinity of Nome, Alaska, there are dozens of open shafts on the tundra, with nothing to mark their situation save the small pile of dirt that has been taken out. During the winter the snow will drift over these, completely covering them, thus making an excellent trap for the cross-country traveler. Many times it is a case of negligence whereby they are left open, but too often it is due to careless and irresponsible persons who do not realize the seriousness of this class of stealing.

Underground Grizzlies

Much trouble has been experienced in the mines in the Ducktown basin of Tennessee from the ore in the stopes breaking into such large pieces that it could not be handled or would not run in chutes without blocking. In the large underhand stopes, when the ore is milled down to the haulage level in benches from 5 to 7 ft. high, this difficulty, although annoying, is not serious, as the miners with blocking drills can easily drill the large lumps and shoot them into



ARRANGEMENT AND CONSTRUCTION OF UNDERGROUND GRIZZLY

such pieces as can be handily loaded into the tram cars. However, in using a system of mining in which the ore is drawn from the stopes in chutes this difficulty at times becomes so serious as to preclude the possibility of drawing the ore from the stopes through chutes. At the Tennessee company's mines several types of chute have been tried in connection with their shrinkage or back stopes, but none have given any satisfaction; all being liable to choking from the large masses of ore which they have to deliver.

Recently, however, J. V. Bohn, super-

intendent of mines, for the Tennessee Copper Company, has introduced a type of underground grizzly in the Burra Burra mine, which has proven so successful that in the future it will be used in connection with all the shrinkage stopes where large pieces of ore have to be dealt with, i.e., on the hanging-wall side of the orebodies where the larger lumps tend to gravitate. These grizzlies, as shown in the accompanying drawing, are very simple and require practically no repairs for maintenance. An opening is made into the side of the haulage way or drift and a platform cribbed up with 10x 10 timbers on either side, leaving a space into which a car may be run from the drift. Across the top of the opening left for the car, old track iron is laid at 15-in. spacing, the iron being seated in the timbers on either side. At either side of the platform openings are made to the stope above, these being made large enough so that ore of any size liable to be encountered will be readily delivered upon the platform.

To fill the car the trammer simply runs it under the grizzly and with a pick draws ore from the mouth of the chute over to the grizzly bars, the fines, or materials of such size as can be handled by the crusher, passing through the bars, while large lumps are retained on the platform. These can be readily blocked while still on the platform, with no danger of destroying the grizzly, there being no gates or movable parts to the device.

The underground grizzly serves the same purpose as the "chinaman" used in Australia and fully described in the JOURNAL of Sept. 4, 1909, p. 472. This chute consists of a platform erected beneath a hole in the lagging above the drift, opened the full distance between two adjacent stulls or caps and from wall to wall. The platform is constructed with loose sliding boards at the center and by moving one of these ore is let into a car under the platform.

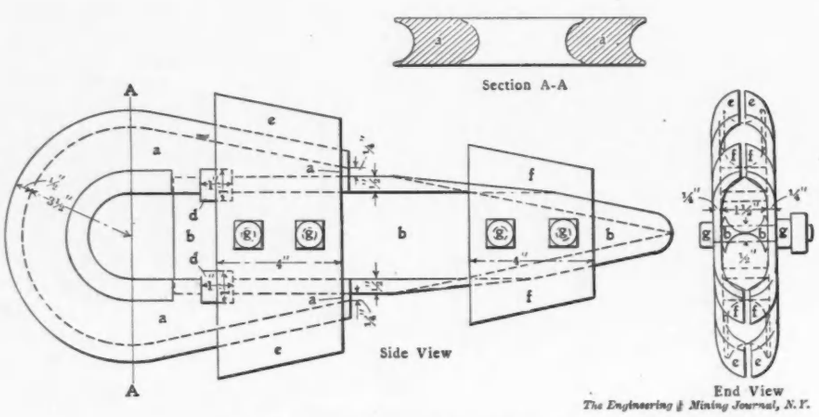
Both arrangements aim to permit delivery of any material broken without blocking in the stopes. The grizzly, however, possesses several marked advantages over the "chinaman." In the first place being at one side of the haulage way, it does not form an obstruction or cut down the head room as does the Australian arrangement. It is also easier to open up the additional space to one side of the drift required for the grizzly than to provide the space above the drift for the "chinaman." Grizzly bars could be provided at either end of the platform to the "chinaman," but "popping" boulders on a light platform over a drift is much more dangerous and liable to cause an obstruction to tramming than doing this upon a cribbed platform at one side of the haulage way.

Thimble for Hoisting Cable

In hoisting the 10-ton skips used in the slopes of the Tennessee Coal, Iron and Railroad Company on Red mountain, Alabama, much difficulty was experienced in fixing the wire rope to the bales of the skips so that they would not pull out. The pull exerted by the hoisting engines is so great that ordinary clamps will not hold at all. This trouble has been overcome by using thimbles of the type shown in the accompanying drawing.

The eye-piece *a*, through which the bale of the skip passes, is keyed to the main shank *b* of the thimble by two square lugs *d*. The clamps *e*, which are drawn down on the cable by the bolts *g*, hold the keys in place. The clamps *f* are similar to the larger ones and are bolted in the same fashion.

The thimble is fitted to the skip bale by removing the larger clamps, thus releasing the eye-piece which is placed about the bale, the key lugs and clamps then being replaced. The hoisting cable passes under clamp *f*, under *e*, around *a* and then back under the opposite ends of *e* and *f*: *b* and *a* are grooved to receive the rope as shown in the sectional views. Finally the clamps are drawn down upon the cable by the bolts upon which lock nuts are used. Usually several ordinary clamps are used to hold the loose end of the rope to the taut end.

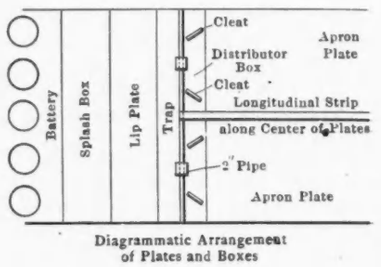


The Engineering & Mining Journal, N.Y.

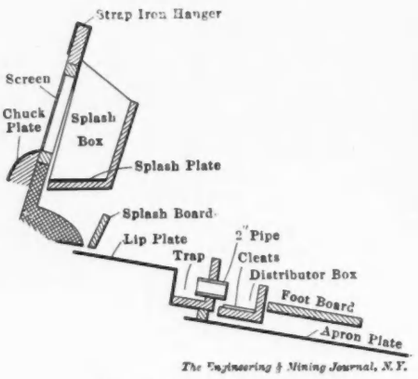
DETAILS OF HOISTING-CABLE THIMBLE

Arrangement of Traps and Plates for Stamp Mill

Though all the traps and plates shown in the accompanying illustrations are in use in the stamp mills of this country, yet the combination, as shown, is of interest as one which gives excellent results. The series of plates, back, chuck block, splash, lip and aprons, together with the drops and the trap above the aprons, almost precludes the possibility of escape of any particles of analgam or amalgamable gold. Another trap is, of course, placed at the bottom of the aprons in the usual manner.



Diagrammatic Arrangement of Plates and Boxes



The Engineering & Mining Journal, N.Y.

SECTION, LAURENTIAN MILL

Referring to the drawings, the pulp passes through the screen into the splash box which is suspended in front of the screen by a pair of strap-iron hangers. The pulp flows off the splash plate over the edge nearest the mortar, falls upon the iron of the mortar box and from there upon the lip plate. The splash board shown is to catch any flying particles. From the lip plate the pulp drops into a box or trap extending the full width of the aprons, and from this trap it is delivered through two 2-in. nipples to the centers of two distributor boxes. These boxes are supported clear of the aprons by strips resting on the edges of the table and by the divider strip at the center of the apron plate. The cleats are tacked in as neces-

sary to secure an even distribution of the flow. The pulp leaves the distributor boxes over the edge nearest the battery, falling upon the apron. The pulp thus impinges upon a plate three times after passing the screen, and, in addition, most of the coarser pieces of loose amalgam are held at the upper trap. On an ordinary grade of ore with this arrangement, there will be but little amalgam on the lower apron plates.

The double arrangement of apron plates is well shown on the accompanying halftone. With this cleat or strip extending longitudinally down the aprons, together with the trap and double distributor boxes,

LAURENTIAN MILL, SHOWING TRAPS AND DIVIDED APRON PLATES

the whole flow of pulp may at will be deflected to one or the other side of the plates by merely putting a wooden plug into one of the 2-in. pipes leading from the trap. In this manner the necessity of hanging up the stamps while dressing the plates is avoided.

The arrangement is particularly applicable to the running of low-grade ores, when the inside plates should be entirely dispensed with, and the hight of discharge regulated to give the maximum capacity without regard to any scouring action that might be set up in the battery.

Cool Air for Compressors

The necessity of having air brought to the compressor in a cool, dry, pure state, through passages somewhat larger than the piston area, constructed of wood or cement rather than of metal, is not sufficiently appreciated by engineers. As an illustration of the effect of the disregard of this rule, P. A. Babb, in a paper read before the Instituto Mexicano de Minas y Metalurgia, describes the case of a well known Mexican mine at which the heads of departments were earnestly working to reduce the operating cost. In this mine, however, an electrically driven air compressor was erected near the collar of the interior shaft at a considerable distance from the mouth of the tunnel.

The air entering the compressor was, of course, that of the room at the collar of the shaft, heated and vitiated by contact with the workings in heavy sulphide ores below. At about 10 m. from the compressor are well ventilated, dry and cool old workings, having a temperature of about 30 deg. below that of the compressor room. A drive of about 5 m. would have made a connection and the cool air so brought to the intake valve of the compressor would have produced an increase of 5 per cent. in efficiency. The monthly operating costs of this compressor were: Power, $1875; direct labor, $195; oil, repairs, etc., $47; total, $2117. An increase of 5 per cent. in efficiency would mean a reduction of $105 on this amount.

Explosives and Blasting—Some "Dont's"

Robert N. Bell, formerly State Mine Inspector of Idaho, in one of his annual reports suggested the following "Dont's," which, although not new, are worth repeating and bearing in mind. "Some of them will appear superfluous to the lay reader, or to the careful and experienced miner," says Mr. Bell, "but from personal experience I know them to be justified."

Don't start to drill in a new face until you have thoroughly satisfied yourself that there are no missed holes or unexploded pieces of powder left in the old butts of cut-off holes. If such are found, reprime and shoot them before starting in to drill, as a slip may connect with the charge that will transmit a sympathetic concussion from the drill, especially if a machine is being employed that may explode a charge while drilling.

Don't depend entirely upon reports. It often happens that the upper part of a charge will explode and the lower part remain alive and unexploded without going off.

Don't be in too big a hurry to go back to a burnt hole or "stinker," or to reprime a missed hole, for it is safer to reprime within an hour, say, than to work over a hole that has missed fire for a half shift, as missed holes will remain apparently dead for several hours without any sign of life, and then, unexpectedly, go off. Several cases of this kind have occurred recently in Idaho with disastrous results.

Don't use any kind of metal tamping bar or tap a wooden one with a hammer when loading.

Don't carry a lighted candle together with powder or a capped fuse in the same hand.

Don't keep caps and fuse in the same place with powder.

Don't store powder in the same room with oils or other inflammable materials.

Don't thaw or keep powder in a blacksmith shop or a dwelling.

Don't jab too hard with a wooden tamping bar, in case a piece of powder fitchers or sticks half way in a hole, when loading, and you cannot push it home gently. Never mind your reputation as a loader. Let the hole spoil. If it should result in your losing your job you will have yourself left, anyway.

Don't carry powder about your person to soften it, or attempt to thaw it in the flame of a candle, or crimp a cap with your teeth, or "break" a stick in two. Cut it, no matter how dull your knife is, and if you hav'n't a knife, go and get one.

Don't jab a pick into a muck pile in the manner of striking a drill with a double hand hammer. You are likely to hit a stray piece of powder that will explode and blow your eyes out. Three such accidents happened in Idaho in 1905. Use your pick to work the stuff down with more of a raking motion. It is safer, and just as effective.

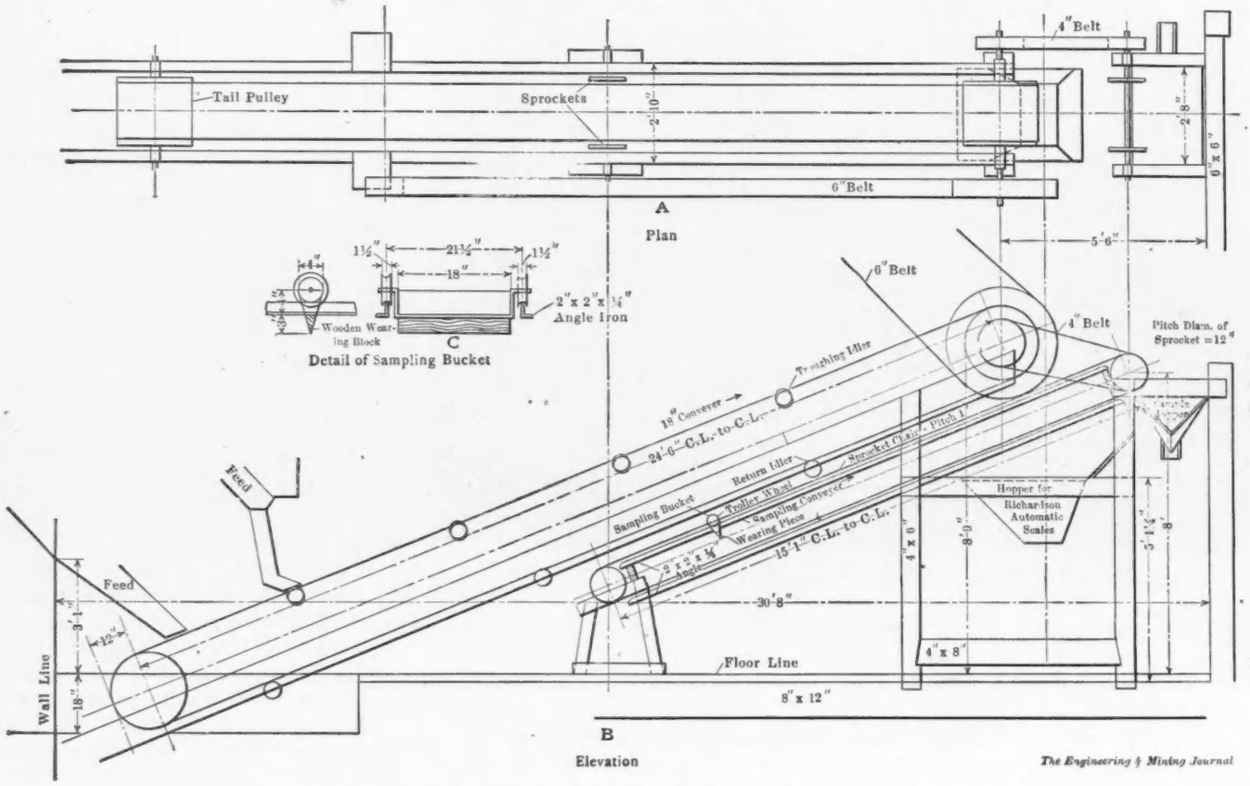
Don't take a naked light into any warm storage place for powder or sub-magazine, or hang a candle over an open box of powder or scatter particles of powder in making a hole for a primer where they are likely to strike a candle flame.

Don't carry loose powder in your arm. Use a small canvas sack which you can swing over your shoulder with a rope loop.

Old powder is dangerous to handle in many ways and hard to explode. Demand fresh powder and strong caps. By practising the above rules and using ordinary care, you will experience little trouble in handling powder.

The Van Mater Sampler

The sampling machine shown in the accompanying drawing was designed by J. A. Van Mater, head of the mining department of the New Jersey Zinc Company. The sampler as first installed at the hard-rock mill of the Bertha Mineral Company, at Austinville, Va., was intended for use in a space where none of the standard grades of samplers could operate satisfactorily. The ore from the crusher house enters the mill on an 18-in. conveyer belt, which dumps its ore into a hopper for a Richardson automatic scale. Between the conveyer belt and hopper there was only 17 in. clearance. This sampler worked easily in the available space and gave such satisfactory results that several have since been installed by the company, and the designer has applied for a patent on the machine.



CONSTRUCTIONAL DETAILS AND METHOD OF SETTING UP VAN MATER SAMPLER

Construction of the Sampler

The idea of the sampler is extremely simple. A second conveyer is arranged to run below and extend beyond the end of a belt conveyer so as to cut the stream of falling ore from the upper belt. On the original apparatus the sampling conveyer was constructed of two parallel No. 25 link 1-in. pitch belts carrying a single bucket. On later samplers No. 45 link belt with about 1⅝-in. pitch was substituted. The sprockets in each case were 12 in. pitch diameter. The buckets or sampling troughs, of which any desired number may be used, must be as wide as the stream of ore delivered from the belt, and also must be deep enough to contain all the ore intercepted, as will be explained. The details of the sampling troughs are shown on the accompanying drawing in plan and section at *C*. The length and number of the buckets is determined by the size of sample desired and by the number of cuts to be made per minute. The bucket is fixed at either side to the chains of the sampling conveyer, and is provided with trolley wheels which runs upon 2x2x¼-in. angle irons used as tracks or guides. These tracks serve to take the impact when the bucket fills. As shown, a wooden bearing block is provided on the bottom of the bucket; this is pointed so as to offer a minimum resistance to the falling stream of ore through which the bucket must pass on its back journey, and protects the bucket from wear.

Theory of the Sampler

As stated, the length and depth of the sample bucket, as well as the number used, depends upon the size of sample desired. Contrary to what might be expected, the percentage cut by the sampler is absolutely independent of the relative speed of the conveyer belt and sampler, or the number of cuts made by the sampler. The only effect of making a greater number of cuts is to give a better average sample, within certain practical limitations. To understand this, assume the sampler a solid belt. Then irrespective of the speed of either conveyer, the entire discharge from the upper belt will be caught upon the lower one, and delivered as a sample. If, however, in place of a solid belt for the sampling conveyer, one is substituted in which half of the total length of the sampler is made up of buckets and half left open, then it is evident that one-half of the discharge from the upper belt will be cut as a sample. Similarly, if any desired proportion of the total length of the sampling conveyer is made up of a bucket, or any number of buckets, that proportion of the total stream delivered by the upper belt will be delivered as a sample. Hence the total length of the bucket or buckets with respect to the length of the sampling conveyer alone determines the proportion of the discharge from the upper belt taken as a sample. The respective speeds of the two belts, the number of cuts made by the sampler, or the number of buckets into which that portion of the sampling conveyer which is to catch the stream from the upper belt is divided, only affect the quality of the sample. The object of making several cuts a minute is to get a more average sample, and this can be accomplished by using several buckets or by running the belt at a greater speed. The buckets, of course, must be the full width of the stream delivered from the upper belt and also must be large enough so that all of the ore, falling into them, will be retained.

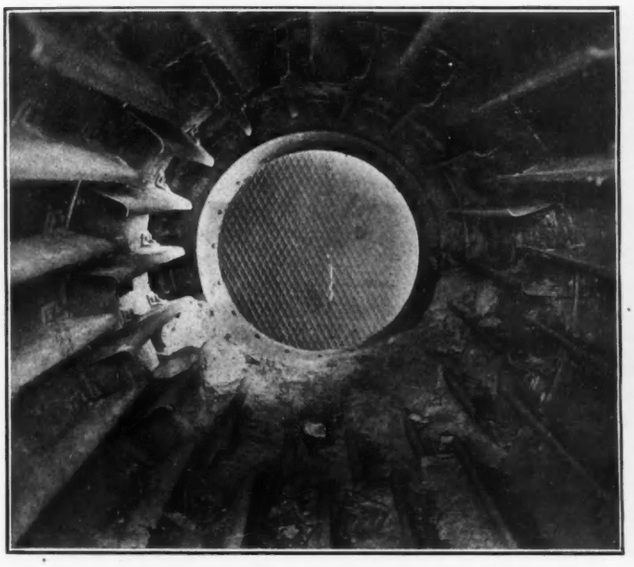
In the design shown, the sampling conveyer is about 33 ft. long, and the bucket

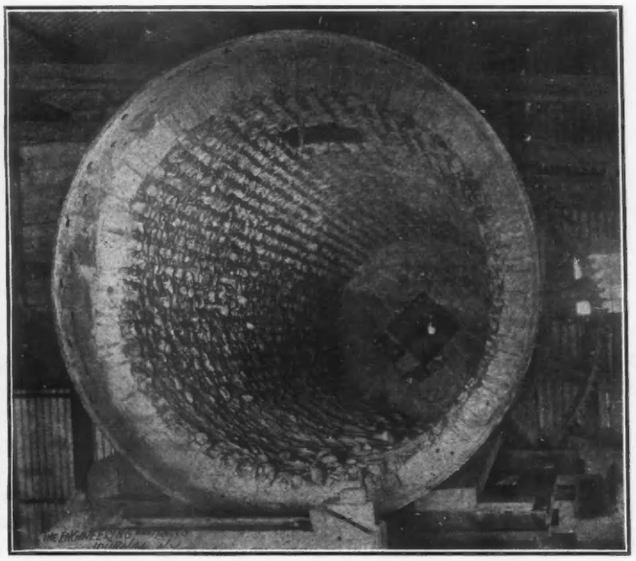
4 in. long, a proportion of 100 to 1; therefore, a 1 per cent. sample is delivered. As installed, the sampler is run so as to make 6 cuts per min., this being regarded as giving a fair average sample. Running faster, it was found that too great an amount of the ore was spilled.

New Tube Mill Linings

On account of the ever-growing, prominence of tube mills in connection with stamp-milling operations, especially in the Rand, the two illustrations of new types of linings recently patented by Messrs. Gibson and Schillie are of interest. These liners have been tested, but no data concerning the tests are at hand.

In the one, an arrangement of steel plates, curved on the outer edge, is bolted to angle-iron standards set inside the shell of the tube mill. The lining consists of fragments of any hard rock, such as gold-bearing banket, set in concrete between the plates. The other photograph shows another construction wherein the darker rows are made up of the heads of short pieces of worn-out drill steel set in concrete with rows of pebbles caught between them.





TWO NEW FORMS OF CONSTRUCTION OF TUBE MILL LININGS

Volumetric Method for Determining Alumina

A method, given by W. H. Seamon in *West. Chem. and Met.* V, pp. 62-64, for the volumetric determination of alumina, is based on the perfect separation of all the members of the fourth group, except zinc, from alumina, this being attained by sodium peroxide. The alumina enters solution as sodium aluminate and is precipitated by exact neutralization of the solution. The precipitated hydroxide is redissolved with a standard solution of sulphuric acid.

The precipitated hydroxides of iron and alumina from the usual lime determination are thoroughly washed with a boiling solution of ammonium chloride to insure the removal of zinc. The hydroxides are then dissolved in the least quantity of concentrated hydrochloric acid necessary for complete solution. Two to five grams of pulverized sodium peroxide are added cautiously to avoid spattering to the solution held in a No. 2 casserole. A sufficient excess must be added to make the solution strongly alkaline. The precipitate is filtered off, using a filter pump if desired, and washed twice with boiling water. The alumina is present in the filtrate as sodium aluminate along with any zinc that was not removed by the ammonium chloride washing. The presence of zinc or lead will, however, render the determination worthless.

A drop of phenolpthalein is added to the filtrate and then either dilute hydrochloric or sulphuric acid to the point where a gelatinous precipitate begins to show, care being taken that the pink color of the indicator is not removed. The neutralization is then carefully completed by running in a standard sulphuric-acid solution from a burette. Caustic soda may be used to bring back the solution if the end point is overrun. The liquid is heated to near the boiling point, a drop of methyl orange added and standard sulphuric run into the hot solution until a permanent acid reaction is obtained. The pink color should remain permanent after one or two minutes' standing, and the solution clear. The amount of standard acid for this latter titration is accurately measured.

The standard acid solution contains 8.3 c.c. of 1.84 sp.gr. sulphuric acid per liter and should have a value of 1 c.c. equivalent to 0.005 gram alumina. The solution is standardized against 1 gram of pure potassium alum (10.86 per cent. alumina) dissolved in 100 c.c. water. One gram of sodium peroxide is added to the dissolved alum, then a drop of phenolphthalein and the method as described followed out.

A check on the final titration is possible if the point where the acid begins to react with the sodium aluminate is noted and the amount of acid required from this point to the fading of the pink color of the phenolphthalein observed. The aluminum hydroxide dissolves most rapidly in a boiling solution of sulphuric acid, although not instantaneously, so that constant stirring and time are necessary toward the end of the reaction. Zinc and lead, if present, consume acid and so render the determination valueless. In their absence the decomposition of the sample by acids or fusion may be followed directly by the addition of the peroxide. Sodium peroxide is preferable to sodium or potassium hydroxide on account of its greater freedom from alumina. The largest amount of alumina found in the sodium peroxide was a trifle less than 0.01 per cent. The method is rapid and apparently accurate.

Encinnillas Mines and Smelting Works

The Encinnillas Mines and Smelting Works of Santa Rosalia, Ltd., formerly a British corporation, is now under French control, its main office being at 47 Boulevard Haussmann, Paris. The company operates a lead smeltery at Santa Rosalia Camargo in Chihuahua, the title of the Mexican company being Fundicion de

Santa Rosalia. The company has been negotiating for some time for further capital to enlarge its present plant, which consists of one 46x52-in. rectangular furnace and two 42-in. circular furnaces, with the necessary blowers, steam engines, boilers, pumps, etc. Since Dec. 22, 1908, the plant has smelted about 25,000 metric tons of ore and produced 3300 tons of bullion averaging 98 per cent. lead, 100 oz. silver and 1 oz. gold per ton. The matte produced, amounting to about 1000 tons, is sold in Mexico. The bullion, however, is shipped to England.

Owing to the large portion of pulverulent lead ores in the charge, the capacity of the plant has been greatly reduced and at the same time, through the absence of flues and settling chambers, the lead losses have been high. Extraction of gold and silver is said to be satisfactory. The officials at the plant are of the opinion that a liberal return can be obtained on the capital required for the enlargement and improvement of the plant, and have recommended the installation of two new lead furnaces, 42x180 in., with necessary power equipment and the enlarging of the settling chambers. A briquetting machine may also be installed. The present plant will then be used as a reserve. The company owns the Dolores group of mines situated about 75 miles east of Santa Rosalia. These mines, however, are closed. If the present negotiations for further capital are successful the company will probably acquire other properties in the state of Chihuahua. J. L. Saint-Dizier is general manager of the company's Mexican properties.

Failure of a Cooperative Mining Enterprise in France

A striking example of the failure of socialistic theories when practically applied is given by Edward Vicars, British Consul at Lyons, France, in his latest report to the Foreign Office as reported by the London correspondent of the *Sun*.

The enterprise was known as the Miners' Mine, in the Loire coal basin, and was started in 1891 and heralded as marking the inauguration of a new golden age of industrial coöperation. A concession, consisting of four pits, covering an area of about 183 acres, had been obtained at a low price from a Paris banking firm, and subscriptions flowed in from all sides, including $10,000 from the French Government and $2000 from the town of St. Etienne.

Having thus secured working capital, the Miners' Union set to work to frame the statutes of the new society, the essential point of which was that all profits were to be divided among the workers in the mine. Dissensions and difficulties were not long in making their appearance, and practically never ceased until the final closing down of the mine.

The chief of these disputes arose from the fact that soon after the opening of the mine the regular members of the society began to get in outside men to help. These auxiliaries gradually came to consider themselves just as much shareholders as the original members, and therefore equally entitled to share in the profits. Moreover, it not infrequently happened that when funds were low an all round pro rata reduction had to be made in wages—an arrangement which caused great dissatisfaction among many of the men, who, being unable apparently to grasp the principle of coöperation, demanded their full wage.

Finally a general meeting was called to settle these difficulties, at which it was decided to divide the workers into two separate categories—members of the society in the strict sense of the term, who should take their chance of pay according to the ready-money position of the company from week to week, with a right to participate in profits, and auxiliary men with regular wages, no matter how empty the treasury, but with no right to any dividend. This decision raised an outcry among the ready-money men, who declared that it ran counter to the whole spirit of the enterprise, the principle of which was that all should share alike on a coöperative basis.

This quarrel marked the beginning of the end. As far as can be ascertained no great amount of profits found its way into the pockets of the miners, even in good times, large sums being spent by the directors in developing the existing property of the company and in acquiring fresh mines. Heavy loss was sustained by reason of a successful suit brought against the company by another colliery on whose territory the Miners' Mine had encroached.

Charges of corruption were freely brought, but there is no need of any such explanation to account for the disastrous career of the enterprise. Quarrels followed thick and fast; chairman after chairman was elected, only to be intrigued against and forced to resign. Serious fires in two of the pits contributed to hasten the inevitable crisis, and the hard times in which the whole of the Loire basin suffered found the Miners' Mine least of all able to make head against the storm. Money began to run short, creditors became pressing, and at length a receiver was put in and the pits closed down.

The term "load," used as a unit of ground measurement by the South African diamond mines, represents about 16 cu.ft. of material, the contents of an average skip or car.

Tin Mining in Bolivia

According to recent British consular reports, the total production of tin in Bolivia, during 1908 was as follows: Potosi, 18,139 tons; Oruro, 9620; La Paz 2008; Cochabamba, 170; total, 29,937.

The average value of the boliviano in 1908 was 1s. 5d., as compared with 1s. 8d. in 1906 and 1907.

The principal mines are situated in and around the city of Potosi, in Chorolque, Tupiza, Uncia, Llallagua, and Huanchaca.

An express train now runs weekly from Oruro to the coast, with very comfortable sleeping and dining cars, and the journey can be made in 36 hours. The La Paz-Oruro passenger line has been running for some months. The Oruro-Potosi branch has been definitely abandoned, and the rich mining centers of Huanuni and Uncia will still have to transport their products by llamas, donkeys, or carts.

Tin mining is still almost the only industry of the Oruro district. Several new workings have just been begun in the Huanuni Morocacala, and Negro Pabellon districts, and an increased output is expected in 1909. One mine is now shipping 10 tons per day of 58- to 60-per cent. ore without treatment, save picking at the mine. Several completely new dressing works have been erected, on which about £250,000 have been spent; but, unfortunately, in most cases very little has been expended in developing the mines.

The Bolivian tin production mostly comes from four or five districts—Huanuni, Uncia, Potosi, and Chorolque, La Paz, Berenguela, Avecaya-Antequera. It costs £22 to send a ton of 65-per cent. barrilla to the United Kingdom. Generally only the poorer and less developed parts of the mine are rented to *pirquineros;* £1 8s. 10d. may be taken as a fairly high price in this district for metal of 60 per cent. in *pirquineros,* and 16s. for 50-per cent. ores. For the year 1908 one company showed a cost in the mine of about 20 bols. (say £1 10s.) per quintal for a production of nearly 2000 tons, of which over four-fifths gave an assay of over 69 per cent. metallic tin. A smaller company is now producing about 800 quintals per month at a monthly cost of £2000, and that from ore that barely averages 3 per cent., which is very low for this district, and still making a profit.

Some of the properties secured by Chilian capital were good, but the prices paid were, almost without exception, far above the face value, and most of the undertakings are now in difficulties.

The interpretation of the mining law leaves much to be desired. A civil lawsuit will usually take a fair lifetime to be settled. It is a safe criterion of the value of a mine to count the number of its lawsuits. There is scarcely a mine in the country of any value that does not defend at least a half-dozen lawsuits.

The Joplin District under the New Tariff

By C. H. Plumb*

Before the passage of the Payne tariff law the United States as a whole and the Joplin district in particular suffered from lack of confidence.

Crops were good, the zinc mines were looking better than ever before and business was inproving all the time, but no one knew just what the tariff bill was to be and everyone was afraid to spend money and go ahead. The Joplin zinc-lead district suffered from the general depression, and in addition was fighting for its life against a trouble all its own—the free importation of Mexican zinc ores.

Long before the panic of 1907-8 struck the United States, the price of zinc ores began to fall. Mexican imports of zinc ores had increased from 22,137 tons in 1905 to 103,117 in 1907, and the price of zinc ore had fallen so that mining had ceased to be profitable except in the richer mines. Jack was bringing only from $30 @35 per ton, where formerly it brought from $50@55. Practically all the low-grade sheet ground mines were shut down and mill building was at a standstill. Wages were cut and the miners worked for $1.50 a day rather than have no work at all.

As a result of this condition more prospecting by miners for soft-ground free ores was done from 1907 to 1909 than during a decade before. Some of the mines piled up their ore and ran through the period of low prices, but the majority were unable to do so. When the fight for a tariff was made and a duty seemed assured, prices of ore began to ascend and a few of the mines resumed, but the majority waited till the passage of the Payne bill in August assured good prices for jack for some length of time.

Most of the imports have been silicate ores and the price of silicate has gone up from $17 to $29 per ton since last August, and the price of jack to $52. Every mine in the district with pay dirt is running. One noticeable result of the tariff is the buying of large fees by local and outside capital and the prospecting of outlying camps with drills. If the deposits here were in well defined beds, fissures or veins, large companies would long ago have secured control of the output; but in this district ore is where you find it and a geologist is like a fish out of water. Everybody has an equal chance, and the large company and the small miner must prospect their land to determine its value.

Sarcoxie, Neck City, Spring City and the Baxter-Quapaw camp (which six months ago was practically dead) are coming to the front. The West Joplin sheet-ground district has six mills running and as many more to be built, where six months ago not a wheel was turning.

Investors are coming into the district and properties are changing hands every week. The miners now are getting as good wages as they ever did and labor for the mines is becoming scarce.

While Joplin once had high ore prices with no tariff on zinc, it was before the Mexican mines were developed and the imports were practically nothing; with imports of 10,000 tons per month high prices are impossible.

Joplin at one time could have prosperity on $30 jack, but in these times, with the increased cost of mining supplies, labor and the necessities of life, $50 jack is a necessity. In short, the Joplin district now has prosperity where a year ago the conditions were worst.

*Civil and mining engineer, Keystone building, Joplin, Mo.

Petroleum and Natural Gas in the Philippines*

By Warren D. Smith†

There has been considerable interest aroused within the last year by the tapping of small reservoirs of natural gas in the course of drilling for artesian water. Two of these cases were investigated and it was found that only a small pocket of gas had been penetrated and that the supply was exceedingly small and intermittent.

Petroleum

Petroleum has been found in five places in the Archipelago—three in Tayabas Province, the other two on the island of Cebu; one near the center of the island on the west coast not far from Toledo, the other near the southern extremity, close to the *pueblo* of Alegria. In Tayabas and at the first-named locality in Cebu some prospecting by means of boring has been carried on, but as yet the Alegria field remains practically unknown. The oil in all three of these localities is found in a bluish shale, presumably of Tertiary age.

In Tayabas province on the east coast of the peninsula south of San Narciso Mr. Cook drilled a well 21 m. deep and found some oil. This well is in the Vigo river valley. On the Bayhay river there is another well 40 m. deep, belonging to a different company. In the latter well, which is about 8 km. from the coast, the yield at the beginning was reported to be about 190 liters per day. The well has a 5-in. bore and was made with a light churn drill. The oil appears to be of a very good grade. It has a paraffin base and its composition is very like that of the Sumatran oils.

The Cebu Oilfield

In Cebu, near the town of Toledo, about three miles from the coast and just at the edge of the foothills, are two wells, the first to be sunk in the Philippine archipelago. These are on the sugar estate of Smith, Bell & Co. These wells are sunk in shaly strata (in all likelihood similar to the formation in Tayabas) to the depth, respectively, of 244 and 344 m. Very fair shows of oil have been reported from these wells in former years, but at present all operations have been suspended in the district. In fact, nothing has been done in this field since the outbreak of hostilities in 1897, and when the writer visited the field he found the wells choked up with *abacá* stalks and other refuse material, said by the natives to have been placed there by *insurrectos*. The elevation of the surface at these wells is 23 m. above sea level. There was only one derrick standing. It was approximately 18 m. high, the borings were 3 in. and the casing 6 in. The strike of the strata is north 83 deg. west, dip 73 deg. to the south.

About 2 km. from the oil well is an outcrop of coal which in former years was worked to some extent, but is now abandoned. From a hasty reconnaissance of the country it is my opinion that the strata are less disturbed in this portion of the island than on the eastern side of the Cordillera or to the south, in the vicinity of the Alegria oilfield. It is the intention of the Division of Mines to undertake a more detailed survey of this region at an early date, with a view to the rapid delimitation of the coal and the oil-bearing horizons.

The Alegria Oilfield

At Alegria the oil is found at an elevation of 350 m. on the Malbog creek, about 3 km. in a straight line from the coast. At 441 m. a bed of poor brown lignite is found. The strata here dip eastward, or into the island, being quite different from what was found in the Toledo field. The rock capping on the surrounding hills is a coralline limestone of probable Pliocene age. The oil appears to be identical with that from the other two fields and is found oozing out of the same bluish shale. To those intending to explore this field I would recommend that a light drill be taken just over the divide, about 1 km. to the east from the place where the oil at present comes to the surface, to a point where the topography reaches its lowest elevation, where the oil-bearing stratum would be found under better cover.

Prospects

With reference to the likelihood of finding oil on the east coast of Cebu, I might add that although the sedimentary formations are the same, yet a great area

*From "Mineral Resources of the Philippines, issued by the Bureau of Science, Manila.

†Chief of Division of Geology and Mines, Manila.

of igneous rock which occurs there would cause serious interruption to the oil-bearing formation. The apparent connection between coal and oil deposits in Cebu and other islands of the group leads me to think that in time oil may be found in paying quantities in many parts of the archipelago.

The Ontario Mining Report

SPECIAL CORRESPONDENCE

The eighteenth yearly report of the Bureau of Mines of Ontario[1], just issued, presents a comprehensive review of the mining industry of Ontario for the year 1908, with statistical tables showing the quantity and value of the mineral output, besides much other information regarding mining conditions and the work of the bureau. The data as to mineral production published early in the year have undergone careful revision, resulting in some changes in the figures; the value of net metallic production being given as $16,754,986, and of non-metallic production as $8,882,631, making a total of $25,637,617, an amount considerably in excess of that given in the preliminary statement. It is pointed out that owing to the different methods employed in valuing mineral products for statistical purposes by the mining departments of the Dominion government and the several provinces, great discrepancies occur between the figures of the Canadian Geological Survey and those of the Provincial Bureau of Mines. For instance, the value assigned to the nickel output of Canada—which all comes from Ontario—by the survey is $8,231,538, while the bureau's valuation is only $1,866,059. The survey values the nickel contents of the mattes produced at the Sudbury furnaces at the average price of refined nickel in New York, while the bureau's figures represent the value of the nickel in the form of matte, and at the point of production as given by the producers. On this point the report says: "To reckon the charges for transportation to the United States or England, the cost of separating the nickel from the matte, and probably also the profit arising from the whole series of processes to which the ore is subjected from mine to finished product, as part of the value of the nickel when it leaves Canada in the matte, certainly helps to swell the aggregate value of the mineral production, but the propriety of the method is not free from doubt." In dealing with pig iron, on the other hand, the survey credits Canada only with the product of Canadian ore excluding all pig iron made from imported ores, while the bureau includes all pig made at the blast furnaces of the Province, deducting from the aggregate the value of the Canadian ore smelted so as to avoid reckoning its value twice, once as ore and again as pig. The report expresses the wish that a common system might be adopted by the Dominion and Provincial mining authorities. In order to enable the mining production of Ontario to be fairly compared with that of the other provinces a table of the metallic output compiled on the Geological Survey basis is given, making the total $22,330,062, in place of $16,754,986 according to the plan followed by the bureau.

[1]"Eighteenth Annual Report of the Bureau of Mines, Ontario, 1909;" part I; pp. 311; illustrated. Toronto; L. K. Cameron, King's Printer.

SILVER PRODUCTION

An attempt has been made to ascertain the entire yield of silver in Ontario up to the end of 1908. The statistics of production in the earlier days of the silver-mining industry were not officially collected, and cannot be exactly obtained, but data from several authentic sources show an approximate production of 4,748,541 oz. valued at $5,135,681 previous to the opening of the Cobalt mines. The yield of the subsequent period, ending with last year, was 37,586,970 oz. of the value of $20,468,751; making a total of 42,335,511 oz. of the value of $25,604,432. In dealing with the government revenue from mines the value of the ore shipped from the Provincial mine, while it was operated by the government is for the first time made public. The shipments consisted of two carloads of cobalt ore and one carload of silver ore, the total receipts from which were $12,317. The 48,625 lb. of silver ore assayed 783.17 oz. of silver to the ton.

MINE ACCIDENTS

A somewhat larger section of the report than usual is devoted to mine accidents, which have greatly increased in frequency of recent years. There were 47 fatalities, 14 men seriously and 26 slightly injured during the year. Of the total number of accidents 32 occurred in the Cobalt area, of which 30 resulted fatally. Mining Inspector E. G. Corkill reports that from a close analysis of the fatalities it is found that 44.7 per cent. resulted from danger inherent in the nature of the work; 31.9 per cent. through neglect or carelessness of the management; 8.5 per cent. through the fault of a fellow workman; and 14.9 per cent. through the fault of the injured person. Lack of discipline and supervision are the two chief causes for a number of the accidents at Cobalt. Inspector Corkill also contributes a descriptive account of the mines of Ontario with details as to their condition as regards equipment and development.

ONTARIO IRON RANGES

The series of reports dealing with the iron ranges of northern and northwestern Ontario, commenced in previous issues, is continued in the present volume, including the following papers: "Iron Ranges of Nipigon District" and "Black Sturgeon Iron Region" by Dr. A. P. Coleman; "Iron Range North of Round Lake," and "Bog Iron on English River," by E. S. Moore; "Iron Formation of Woman River Area," by R. C. Allen, instructor in geology in Michigan University; and a detailed study of the "Geology of the Onaman Iron Range Area," by E. S. Moore. M. B. Baker furnishes an account of explorations in the region adjacent to Lake Abitibi and Dr. A. P. Coleman gives a description of Lake Ojibway, the last of the great glacial lakes and presents his views on the classification and nomenclature of the drift of Ontario. Part II of this report, dealing with the silver areas of South Lorrain and Gowganda, appeared some time since as a separate volume.

Copper Deposits of Greene County, Virginia

BY MARSHALL HANEY*

The copper deposits in Greene county, are on the eastern slope of the Blue Ridge mountains at an elevation of about 2800 ft. above sea level. The Blue Ridge is composed largely of pre-Cambrian rocks, represented by various igneous types. Copper has been known to exist along the Blue Ridge since the earliest settlement; native copper furnished the Indians with metal from which they made axes and ornaments.

The ores comprise native copper, cuprite, malachite, bornite and chalcopyrite. The ore generally occurs along crevices and joint-planes, in small irregular lenses of quartz and as disseminated grains through the more epidotized portions of the altered rocks. When ore-bearing, the rocks are generally yellowish green, due largely to the formation of epidote and chlorite.

It is believed that the ore has been formed by the concentration of material leached out of the copper bearing portions of the igneous rocks. The shear zones have offered a place for collecting the solutions and deposition of ore. The ore seldom occurs in continuous masses, but can be traced for miles by the copper-bearing débris.

The mine of the High Top Copper Company is the most extensively developed mine in the county. It is on the summit and southern side of the spur of High Top mountain.

The company has a number of good buildings, a power plant, a 100-h.p. air compressor, 20-h.p. hoist, pumps and drills. The workings consist of open cuts along the outcrop, a crosscut tunnel about 150 ft. in length, and a shaft 115 ft. deep. Another tunnel enters the hillside about 400 ft. from the summit of the ridge and has been driven about 200 ft.

The various companies holding prospects are in need of capital to carry on development work. Plenty of cheap labor, good timber and water power are at hand.

*Geer, Virginia.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

P. K. Horner is now superintendent of construction for the Union Minière Du Haut-Katanga at the Star of Congo mine.

C. B. Wilmott has returned to Sault Ste. Marie, Ont., from British Columbia, where he has been examining some mining claims.

R. B. Lamb, of the C. L. Constant Company, is making a professional visit to northern Mexico, and expects to be absent about two weeks.

Charles Conners has been appointed field and office assistant to Chief Mine Inspector Laing, of West Virginia. He succeeds J. Austin King, resigned.

P. R. Whitman has left the Virginia & Mexico mine at Hostotipaquillo, Jalisco, to accept a position with the Real del Monte, at Pachuca, Mexico.

Leonard Peckitt, president of the Empire Steel and Iron Company, has been elected president of the Eastern Pig Iron Association. W. S. Pilling has been re-elected secretary.

J. A. Mowbray, of London, England, was in New York last week, having just completed an examination of the York Harbor copper mine in Newfoundland for English parties.

Guy C. Stoltz, mining engineer with the Port Henry Iron Ore Company, at Mineville, N. Y., visited Cobalt, Ont., and examined property in the new Gowganda district, recently.

Dr. H. J. Burgin, formerly connected with the Fresno Magnesite Company, of Fresno, Cal., has been appointed superintendent of the Talbot Dyewood and Chemical Company at Lowell, Massachusetts.

W. L. Caulkins has retired from the active superintendence of the Yellow Dog mine in the Joplin district of Missouri and Messrs. Coats & Ortt will have the active charge. Mr. Caulkins will remain general manager.

E. Gmelin, formerly with the Peñoles Mining Company, at Mapimi, Durango, and later manager of the Candelaria Mining Company, at Pinos, Zacatecas, has opened an office as consulting mining engineer at Aguascalientes, Mexico.

T. J. Jones, for seven years superintendent of mines for the Mountain Copper Company, Ltd., in Shasta county, Cal., has removed to San Francisco. While still retaining a connection with the company, he will also engage in general practice.

T. W. Atterbury will leave the service of the Copper Queen Consolidated Mining Company at Douglas, Ariz., Dec. 31. He made the first general layout of the smelter, over eight years ago, and has been in charge of the engineering office at Douglas ever since it was established. He will go East on an extended trip before taking up another position.

Obituary

Capt. Thomas Pidwell, a pioneer of the Turquoise district in Arizona, died at Tucson, Ariz., last week. He was buried at Tombstone.

E. B. Dear, who died at Duluth, Minn., last week, was for many years largely interested in mining. He was one of the promoters and the first president of the Butte-Ballaklava Copper Company operating in Butte ,and was also a director of the Keating Gold Mining Company, operating in Broadwater county, Montana.

William Adams, a mining engineer and promoter well known in Mexico, committed suicide at Chihuahua, Dec. 8. The cause for such action is unknown. He was born in the United States and was about 64 years old. He had been engaged in mining in the United States and in Australia before going to Mexico. He had lived in Chihuahua for nine years and was well known there and elsewhere, largely by his published reports on the Santa Eulalia camp.

Israel Wistar Morris died at Philadelphia, Penn., Dec. 18, aged 82 years. He was born in Philadelphia and as a young man became engaged in the work of developing the anthracite field, acquiring a considerable reputation as a mining engineer and coal expert. For a number of years he was associated with the late Robert Hare Powel as a coal operator. For a long time he was president of the Locust Mountain Coal Company, and he assisted Judge Asa Packer in the building of the Lehigh Valley railroad. When 70 years old he retired from active business, and devoted himself to literary pursuits; being frequently consulted on coal questions. He was a member of the American Institute of Mining Engineers and of the American Philosophical Society.

Dr. Chas. B. Dudley, chief chemist of the Pennsylvania Railroad Company, died at Altoona, Penn., Dec. 21, aged 68 years. Doctor Dudley was born in New York, and after serving in a New York regiment in the Civil War, took up the work of a chemist with success. He had previously graduated from Yale College. When the Pennsylvania Railorad Company started its testing department at Altoona, over 25 years ago—the first of the kind in this country—Doctor Dudley was placed in charge. He organized the work and speedily proved its value to the company. Thenceforward his work was along this line and he became widely known to chemists and metallurgists everywhere. As time went on he contributed largely to technical journals and society proceedings, believing in sharing the results of his investigations with the scientific world. His studies into the composition and testing of rails and rail steel were of especial value. His services were recognized. He was president of the American Chemical Society, member of the Iron and Steel Institute, president of the American Society for Testing Railway Materials, and was recently elected International president of the Society for Testing Materials at the meeting of the society in Copenhagen. He was a member of many societies. Personally Doctor Dudley was a man with many attractive qualities, and he had many warm friends.

Richard Eames was killed in an accident on the Southern Railway at Reedy Fork, N. C., on Dec. 15. He was born in New York in 1858 and began work when 17 years old as assistant to his father, Dr. R. M. Eames, in explorations in the Lake Superior county. Under his father he received a thorough training as a mining engineer, and was subsequently employed in many important positions. In 1879 he settled at Salisbury, N. C., which had ever since been his home. He did much work in North Carolina mines, in examining and exploring for gold, copper, manganese, corundum and graphite and in advising and directing the operation of mines. His work, however, led him to many other mining districts, and he had experience as an engineer in the San Juan country in Colorado, in Nevada, on the Mother Lode in California, in Yavapai county in Arizona, in Rhode Island and New Hampshire. He had also done valuable work in Jalisco, Mexico, in Honduras and in British India. Few men have seen a wider range of mining work, but North Carolina was his special study, and no one was better acquainted with its varied mineral resources and the condition of its mines. He found time also to start successfully the Salisbury Supply Company as a dealer in mining machinery. Unfortunately Mr. Eames found little time to record his varied experiences, and was not a frequent writer; though he was an occasional contributor to the JOURNAL. He was widely known and esteemed for his ability and integrity, and his untimely death is much regretted. He leaves a widow and three children.

Societies and Technical Schools

Yough Valley Mining Institute—This association is one of those organized in western Pennsylvania by the Young Men's Christian Association. The membership is from a large group of coal mines, owned chiefly by the Pittsburg Coal Company. Monthly meetings will be held at Jacobs Creek, and two weekly classes in mining have been organized. The officers elected are: W. M. Kelvington, president; William P. Pilkington, vice-president; James R. McColligan, secretary-treasurer.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Butte, Denver, Salt Lake City, Goldfield, Cobalt and Toronto

REVIEWS OF IMPORTANT EVENTS

San Francisco

Dec. 20—The Kennedy Extension Mining Company, of Jackson, Amador county, has begun suit against the Argonaut Mining Company for alleged trespass on Kennedy Extension ground alleging that some 50,000 tons of ore have been illegally extracted. They consider that $200,000 damages have been done. According to the complaint the Argonaut workings have met veins which outcrop on Kennedy ground.

A decision of the Appellate court in the Golinsky mine-boundary dispute has been given in favor of Bernhard Golinsky. The case may go to the Supreme court eventually. These mines are not far from the Mammoth copper properties in Shasta county and have been worked intermittently by different parties, at one time being under bond to the Guggenheims. The litigation has prevented extended working of the properties.

A meeting of property owners around Wallace, Calaveras county, has been held to protest against the work of the copper smeltery which is operating above Lancha Plana in the Mokelumne River cañon. Measures are to be taken to secure relief from the copper-furnace fumes which it is claimed are causing damage to vegetation in that section.

The Appellate Court for the southern district of California has decided a grubstake-contract case in favor of the man who supplied means for prospecting. John Byrne grubstaked two miners for a prospecting trip into Inyo county on an agreement between them that the three should share whatever discoveries were made. The miners made a number of locations in their own names ignoring Byrne, who brought suit for his interest and the lower court decided against him. On his appeal the court decided that he was entitled to his share of the claims and ordered a new trial.

The condition of the quicksilver-mining industry in California is not very satisfactory at present, notwithstanding the fact that prices have advanced materially within the past few months and that producers are getting much better prices than they did a year ago. All the mines now being worked are handling very low-grade ore, most of it being less than 1 per cent. metal. Only one or two of the mines are paying dividends and some of those which were formerly large producers will, before many months, close down altogether because it does not pay to mine the ore they are finding. No new mines of any great promise have been opened lately because the low prices for the metal have not encouraged men to hunt up new properties or reopen old ones. These conditions should be changed with the advance in market value of the metal and probably will be.

The new mining camp at the summit of the range east of Lone Pine, Inyo county, seems to be very promising if reports are correct. It is 10 miles north of Keeler and eight miles southeast of Lone Pine. The principal claim so far is the Ironsides. Originally located as a silver-lead proposition, but on sinking, the character of ore changed so that it is now ranked as a gold mine. A great many miners, mainly from Nevada, have applied for leases on this property. The situation is not at all favorable for winter prospecting. The claims are in a mineralized belt a mile or more in width. The deepest workings thus far are not more than 100 ft., but the returns are very satisfactory to owners of the claims. Some specimen ore is being taken out of the principal claims. The real worth of the camp will hardly be known before spring as there is already much snow there and little prospecting can be done.

Butte

Dec. 16—While the situation presented by the switchmen's strike is not so serious as was thought might develop, yet the mines are still affected by the lack of cars. The switchmen at Butte have returned to work and the Washoe Company's Moonlight and the Butte & Boston Company's Silver Bow and Berkeley mines and the Parrott mine have resumed. The switchmen at Great Falls, where the Boston & Montana Company's smeltery is, are still out. On the Great Northern Railway, between Butte and Great Falls, there are now stalled about 15,000 tons of the Boston & Montana Company's ore in the Great Northern cars. The ore bins of the Boston & Montana mines in Butte are being emptied so that shipments may be made to Anaconda. The capacity of that smeltery will not allow the treatment of all of this ore but a considerable amount can be handled.

The yearly report of the United States Assay Office at Helena, shows that Montana produced $1,517,387 in precious metals during 1909; Fergus county leading in production with $659,955 and Choteau county was second.

The annual meeting of stockholders of the Idaho Smelting and Refining Company will be held Jan. 3, in Spokane. In his letter to the stockholders, President Anderson states that he has succeeded in interesting capital to the amount of $500,000, which sum will be used for operating, and not for the payment of present liabilities. General Manager J. J. Campbell has been on the property several days and has made arrangements for the water for the smeltery. Machinery is being overhauled and repaired, and it is thought that operations will be begun shortly after the annual meeting.

President Edward Hickey of the Tuolumne company has addressed a letter to stockholders with reference to the rumors that the company's property is to be involved in litigation. He reiterates the statement that the company's attorneys are confident that the North Butte company obtained nothing by the deed which John Morony secured for them a short while ago, since the Tuolumne was already the owner of the property. Mr. Hickey states that the Jessie vein of the North Butte company at the 1200-ft. level united with the Tuolumne vein and from that point down they become one vein. By reason of the fact that the Tuolumne location is eight months older than the Jessie, Mr. Hickey states that, from the 1200-ft. level down, the entire vein becomes the property of the Tuolumne company. He further states he believes that the North Butte company has mined some of the Tuolumne ore at the west end of the Tuolumne claim, and if that be the case legal steps will be taken to recover damages from the North Butte company.

Denver

Dec. 20—Owing to the exceedingly hard granite encountered in the face of the Roosevelt tunnel, a report has gained credence, that A. E. Carlton, the Cripple Creek banker who has the contract, is going to give it up. Those who know Mr. Carlton are well aware that he is not made of that sort of stuff. However, he announces that there is no foundation for the rumor and he will continue the work to completion. The driving has advanced 11,830 ft. and there is less than 3000 ft. necessary to reach the El Paso shaft. It is possible, however, that it may have to be driven a few hundred feet farther to reach the main channel of the underground water of the district.

The Leadville camp is extremely quiet but there are about 3000 men at work. Five hundred men of the above are working through the Yak tunnel, and from 300

to 400 in the Little Jonny, of which George Campion is manager.

The November production of the Bull Hill mine of the Vindicator company is given as 3000 tons, or a gross value of $100,000. One thousand tons of this is said to have averaged 2 oz. gold to the ton and it is also stated that lessees at No. 2 and No. 6 shafts produced 800 tons that averaged $300 per ton and that 1250 tons of $30 ore were shipped from the Hull City and Gloretta shafts. High-grade ore continues to be produced from the 1300 and 1400 levels which is the more gratifying as regards the future of these deep mines when they shall have been unwatered by the drainage tunnel.

The United Gold Mines Company, owning the Wild Horse, Damon, Deadwood and W. P. H., which are credited with a gross production of about $4,000,000, has declared a dividend of $40,000, the first in five years. A. E. Carlton is at the head of this company.

The Jerry Johnson company, A. P. Mackey, president and manager, after paying the dividend of 1 per cent. per share on Dec. 15, amounting to $25,000, still had $41,000 in the treasury and no debts. It is worked under lease by Edwin Gaylord, who is said to have taken out approximately $250,000 gross in the last ten months, the royalty paid being 20 per cent. of the net returns.

Goldfield

Dec. 20—At the Goldfield Consolidated, under the direction of Superintendent H. P. Henderson, the opening of the Hampton stope is progressing at a rapid rate. By the time the improvements are finished at the mill, whereby its capacity is increased from 600 to 850 tons per day, the Hampton stope will be in such condition that a large tonnage can be mined. A crosscut into the hanging-wall of the Hampton stope has opened another shoot of high-grade ore, and it has already been drifted upon for a distance of 150 ft. A discovery has been made in the January vein in the northerly end of the Combination No. 1 claim, where an oreshoot 20 ft. wide running about $20 per ton, has been discovered. J. W. Hutchinson, the superintendent of the mill, expects to have the additions completed soon. The foundations have all been finished and a large portion of the equipment has arrived and is being installed. When completed these improvements will include six 6-ft. chilean mills, 26 Deister concentrating tables, four 8-ft. Callow classifying cones, a pump, compressor, two elevators to be used in connection with the tube and chilean mills, and two agitators. No additions to the cyanide department will be required. The amalgamation tables have been removed from just below the stamps, and have been installed in such a way as to amalgamate the gold in the concentrates. Below the amalgamating plates are other plates covered with blankets for making a further saving of the free gold in the concentrates. During October the average extraction of the mill was 94.49 per cent. Upon the 730-ft. level a sill floor, for the square sets, having a width of 25 ft. has been placed in position. The average value from across the entire top of this stope is $500 per ton, while throughout this distance streaks of high-grade ore showing free gold, and assaying several thousands of dollars to the ton are to be found. At the present time the ore has been opened to its full width for a distance of about 50 ft., while following the hanging wall a drift has been run for a distance of 150 ft., all in ore and at the breast of the drift a crosscut has been run to the foot-wall proving the oreshoot to be of an even width throughout its entire length. It is one of the greatest discoveries ever made upon the Consolidated property and rivals even the famous Hampton stope which today is making an output greater than any other gold mine in Nevada. This same oreshoot has also been drifted upon on the 900-ft. level for 350 ft., but the development has not been sufficiently advanced to fully demonstrate the grade and extent of the ore. The production from the property for November amounted to 19,180 tons from which an estimated recovery of $635,000 was made giving estimated net profits of $480,000.

District Judge Stevens has cited the manager of the Goldfield-Florence Extension company and several others to show cause why an order should not be granted the Florence-Goldfield Mining Company to make an underground survey of the workings. It is claimed by the Florence company that ore is being extracted from its premises, from which they receive no returns.

The railroad between Wabuska and Yerington and Mason will be completed about Jan. 1. The grading is finished past Yerington and the track is laid to within a few miles of that point. Upon the completion of the road an outlet will be afforded the ores of the Yerington district, and a steady production of the copper ores of that camp will be started.

General Manager C. B. Lakenan, of the Nevada Consolidated at Ely, said recently: "While the company is finishing construction at the Ruth mine, it is not the intention to commence regular operations at this property, which is simply being put in shape for quick production in case of emergency. Raises have been driven, and ore pockets and all other underground work is in readiness, except the electrical wiring. The electrical material for this purpose, motors, etc., are all on the ground. It is the intention of the company to open another steam-shovel pit on the Liberty area rather than to operate the Ruth mine for increasing regular production." At the Steptoe works construction continues on the fifth reverberatory, which will be completed during the latter part of January. This furnace will only be used as a spare, it being planned to run only four furnaces regularly. The fifth furnace, however, might be started in case the Cumberland-Ely mine were reopened. There has been no change in the labor situation at this mine, and the company appears to be in no haste to reopen the property while the steam-shovel operations provide sufficient ore for operating the Steptoe works at full capacity.

Pittsburg

Dec. 21—The management of the Pittsburg Coal Company has sent to stockholders a request that they place their stock in a voting trust for four years, in order to prevent outsiders obtaining control of the company. There has been persistent buying for several weeks. Yesterday the common stock sold at 27¼ and the preferred at 75⅛, so that control could be secured by a rather moderate investment by buying a large quantity of common and a small quantity of preferred stock. The common belief is that the buying has been in the interest of certain railroads and the management therefore felt that the control might not be used for the benefit of remaining stockholders. The circular just sent to stockholders points out these facts, and proposes a plan for placing the stock in the hands of a voting trust. The plan is not to become operative unless by Jan. 31, 1910, a majority of both common and preferred stock is deposited. It is provided that during the agreement, until the second Wednesday of March, 1914, the trustees shall not sell the stock at less than 100 for the preferred or 40 for the common. An effort will be made to list the certificates of deposit.

Cobalt

Dec. 20—Several well known people have lately taken up large interests in the new Porcupine goldfields and have already sent in men and supplies to develop their holdings. The firm of McArthur & Co., of Glasgow, Scotland, has acquired the Way and Griffith claims, comprising 240 acres for which the company paid a large sum. This company proposes to sink four shafts to a depth of 200 ft. each, and to develop their holdings with all possible speed. M. J. O'Brien, who owns the O'Brien mine, has also purchased several claims and has sent in 30 men with supplies to last the winter. Part of their equipment consists of a diamond drill. The new road from Matheson is completed.

The Ontario & Quebec Reduction Company is putting in a plant on the shores of Lake Temiskaming to treat the high-grade ores from Cobalt. The mines and the plant will be connected by the Nipissing Central Electric Railway.

The action of the new directors of the

La Rose, in cutting the dividend rate from 16 to 8 per cent., which aroused such a storm of criticism when it was announced, has been justified by the results of the recent development of the Lawson. From the 88-ft. level a raise was started on the main vein, commonly known as the "Silver Sidewalk," and when it reached the surface it was found that the high silver values did not extend to a much greater depth than 15 ft. From the same level, however, some high-grade ore was found in the No. 5 vein. The development of this property has been greatly retarded on account of lack of power.

An important decision affecting several of the mining companies in this district, has been given by the government announcing the intention of giving a material reduction in the royalties the companies are forced to pay. The companies that are to receive this reduction are the Cobalt Townsite, Nancy Helen, City of Cobalt, Wright Silver Mining Company, Railway Reserves, Jack Pot, J. Harris, McRae, Ontario Development and Mining Company, Station Grounds and the Chambers-Ferland. All of these with the exception of the last, pay royalties to the Temiskaming & Northern Ontario Railway Commission, while the Chambers-Ferland pays direct to the government. All of these companies have been paying 25 per cent. on the gross value of the ore, but in the future they will pay 25 per cent. on the net profits. These profits will be ascertained under the provisions of the supplementary revenue act. The properties that are shippers and will therefore be immediately benefited are the Townsite, City of Cobalt, Nancy Helen and Chambers-Ferland. It is interesting to note that none of the companies that are still able to declare dividends after paying the extortionate royalty charges, have been benefited by the reduction. The government is out after the money, and the rights or wrongs of the case do not seem to have been very seriously considered.

Toronto

Dec. 20—Eight further arrests were made yesterday in connection with the systematic stealing of ore from the Cobalt mines. Two Austrian miners named Nicholas Zozotz and Dmytas Andras were arrested on the Cobalt train, each with a bag of ore. Jacob Cohen and Morris Rodchinsky, both residents of Toronto, were taken in custody on charges of receiving. William Jansen and Jaakka Heikkila, Finlanders, were arrested charged with illegally selling ore. All appear to have had dealings with Wilkinson, who is alleged was the center of the system. Cohen had a small ore-refining outfit and had been in the habit of reducing the ore to silver bullion before selling it. At Cobalt, G. McGale and N. A. Van Winkel were arrested, each having made numerous trips to Toronto for the sale of ore.

The business of the J. E. Wilkinson Company has grown rapidly of late years. It had a branch establishment in Buffalo and the Chippewa smeltery employs upward of 50 men. The police claim that the company books show that the company's dealings amount to about half a million dollars a year. A mine official estimates the losses sustained by all the Cobalt mines from theft at about a million dollars annually.

Meetings of the directors of the Dominion Coal Company and the Dominion Iron and Steel Company were held at Montreal on Dec. 17, when a substantial advance was made toward the completion of the merger between the companies. James Ross, president, and R. B. Angus and Graham Fraser, directors of the coal company, handed in their resignations and their places were filled by the election of Sir Henry M. Pellatt to the presidency and J. H. Plummer and Hon. L. J. Forget as directors. The time allowed for the shareholders to choose whether they would sell their shares at $95 each, or retain their interests having expired it was found that the great majority preferred to go into the merger, the withdrawals only numbering 6885 shares. All outstanding matters remaining in dispute were referred to the auditors of the companies for settlement. The basis upon which the amalgamation will take place is all that remains to be considered.

Mexico

Dec. 18—Dr. F. S. Pearson has made the announcement that the company which he has recently formed to engage in the manufacture of chemical products and steel in the City of Mexico, will erect a plant to cost 2,000,000 pesos. The plant will at the outset produce 3000 tons of calcium carbide for lighting purposes, yearly, and will consume more than 500 h.p. of electrical energy from the Necaxa power plant, also controlled by Dr. Pearson's syndicate. The chemical plant will also manufacture soda products, and will, according to Dr. Pearson, produce steel for tools and drills, and make light steel rails using scrap iron and steel by the electrical process.

The sale of the Santa Gertrudis to Camp Bird, Ltd., is practically assured. An accurate history of the negotiations will also be of interest as the business will rank with the most important transactions in Mexican mines of recent years. Attention was first directed to the property six months ago, by a small exploration syndicate of which the original members were Courtlandt E. Palmer, Hugh Rose and F. M. Royer, subsequently joined by John Hays Hammond. This syndicate examined the property and presented it to the consideration of Camp Bird, Ltd. After an exhaustive examination of mine, titles, etc., Camp Bird, Ltd., took over the option which had been negotiated by Hammond and Palmer and deposited 200,000 pesos as forfeit in event of failure to purchase within five months, following Aug. 26, at 9,000,000 pesos. All examinations of the property and titles supplementary to the original examinations, have been completed and the Camp Bird directors have decided to exercise the option. Hugh Rose has been engaged to manage the property and is now occupied with plans for a large cyanide plant to be erected forthwith.

London

Dec. 16—Speaking at a meeting of the shareholders of Fraser & Chalmers, manufacturers of mining machinery, Sir Julius Wernher said that the company had had a fair year and had been able to pay an 8 per cent. dividend. A considerable part of the profit was, however, derived from commissions on the sale of goods not manufactured by the company and therefore the manufacturing business was not quite so good as it appeared from the dividend. He said that while he was a free trader at heart, he was coming round to the opinion that tariff reform or protection in a mild sense was necessary to preserve the manufacturing businesses of Great Britain. His idea was that tariff reform would give greater liberty of action and that the country would be able to claim and receive consideration and reciprocity which it did not even dare to ask for now. He called attention to the fact that one of the largest contracts of the year—that for the electric supply of 150,000 to 200,000 h.p. for the Rand—had gone to Germany. In connection with this statement, it may be remarked that the Germans had already got the start of the English manufacturers on the Rand in the electric machinery business and had put up a large amount of the capital of the Victoria Falls Power Company and were therefore in a favorable position for tendering for new plant.

At the close of his address he referred to the labor question in South Africa, remarking that the mining industry received now a good deal of help which it did not get before. The whole colony and all of the South African states now helped to get natives for working on the mines. The 55,000 imported Chinamen—now almost all repatriated—had been replaced by Kafirs. Not only that but the highest figure of native employment had risen considerably above previous records and had reached 170,000 persons. At present the figures were somewhat lower but the outlook of the number being not only maintained but increased was hopeful. The white labor employed was 22,000 as against 17,000 employed two or three years ago. He thought that the mines were worked with greater knowledge and with better management every year and that the working costs would be still further reduced.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

Sloss-Sheffield Steel and Iron Company—Ore mines Nos. 1 and 2 on Red mountain, near Birmingham, have been drowned out. The stopes run under Shade valley and the roof gave way in several places, owing to insufficient support, allowing a number of springs to drain into the mine. Rush orders have been sent for large pumps, but it will take two or three months to clear the mines. The adjoining mines of the Tennessee and Woodward companies are in danger, and those companies are building concrete walls to shut off the flow of water. The accident has made it necessary for the Sloss company to bank two of its blast furnaces.

Tennessee Coal, Iron and Railroad Company—A contract has been let to the Dravo Contracting Company, of Pittsburg, for the large concrete dam at Wylam, for the water-supply reservoir. A contract has also been let to Wallace Brothers for the extension of the Birmingham-Southern tracks to the dam and pumping station and the new No. 13 coal mine.

Arizona

The Needles smelting plant and numerous mines in Arizona and California have been sold to the United States Smelting, Refining and Mining Company for about $1,000,000.

Cochise County

Gold Queen—This company has elected its first officers as follows: President, James Herron; vice-president, B. L. McKinney; secretary-treasurer, W. A. Bates; superintendent, Sam Berry. The company is developing the Frone group on Antelope hill two miles northeast of Courtland where the rich gold strike was made in October. A shaft is now down 100 ft. and ore taken out which will be sent to the Commonwealth company's mill at Pearce for treatment.

Claire—This gold property in the Chiricahua mountains, 18 miles west of Paradise, has been taken over by the Pawnee company organized locally. It has been extensively developed in years past.

Graham County

Gold Belt—This, the first gold mill in the Clifton camp, is operating, making a good saving almost entirely on the first plate. Paul G. Wuerschund is in charge of the mill.

Gila County

Miami—J. Parke Channing in a letter to Hornblower & Weeks states: "From indications on unexplored portions of our property I believe that these reserves (14,000,000 tons) will at least be doubled, which would either lengthen the life of the mine or warrant largely increasing the capacity for production. Recent reports from the mine, where we are engaged in blocking out the ore for extraction, have been most satisfactory, both as regards the lateral extension of the present orebody and its grade."

Arizona Commercial—The directors have voted to call in the outstanding $500,000, 6 per cent. bonds, convertible into stock at $5 per share. The property is now producing at the rate of between 400,000 and 600,000 lb. per month, and it is expected that it will increase its output to 1,000,000 lb. Development work is now being done on the 700-ft. level.

Arkansas

The Lime Kiln and Bear Hill properties near Yellville will be operated on a more extensive scale and equipment for the concentrating plant will be installed. Thomas E. Malone is manager.

California

Calaveras County

Reiner—At this gravel mine the 20-stamp mill has been started and an order given for an additional 20 stamps.

Inyo County

Confidence—The mine at Tecopa has resumed operations and is again shipping ore.

San Bernardino County

Orange Blossom—This mine near Bagdad has been sold at receivers' sale to John Benair, the president. It was extensively developed but did not meet the expectations of the promoters and in consequence became involved in debt which necessitated the above action. A reorganization is planned.

Shasta County

Midas—This company at Knob, L. A. Macintosh, manager, has cleaned up $28,000 during November with its 20-stamp mill.

Sierra County

Young America—The gravel mine at Forest has been started up again under charge of John Morris, and a contract has been let to extend the 1200-ft. level.

South Fork—The last raise in the breast of the long bedrock tunnel of this mine at Forest has broken through to the lava cap. The raise is supposed to be in the rim of the long-sought channel.

Siskiyou County

Granite—A half interest in this mine on Humbug creek has been purchased by J. W. Nawman, of Goldfield, Nev. He has taken charge and is sinking a new shaft.

Tuolumne County

Mountain Boy—This mine is about to change hands and be reopened. There is a hoisting plant and mill on the property.

Colorado

North American Smelter and Mines Company—Improvements to cost between $25,000 and $30,000 will be made at the former Carpenter pyritic smelter at Golden, and new machinery will be installed. James M. Myers, who has been in charge of smelting operations in New Zealand has been appointed superintendent.

Boulder County

Southern Illinois—The company has become interested in the Golden Message group at Sunshine and expects to install machinery.

Milwaukee—A new hoisting plant is being installed and this property at Sunnyside will be actively developed. The company has purchased the Ruby mill and will reconstruct it into a modern concentrator.

Blue Bird—New York capital is interested and it is reported will erect a concentrating mill for silver as well as for tungsten ores.

Clear Creek and Gilpin Counties

St. Anthony—Denver people have taken a lease and bond on the property on Negro hill, and will install machinery. Dan Munday, Central City, is superintendent.

Saxon—This property, near Georgetown, has been leased by A. Roberts, Georgetown, and active development work will be carried on.

Humming Bird—Holland capital is reported to have become interested in the property near Idaho Springs. New machinery is to be installed.

Great Bonanza—An oreshoot from $14 to $25 per ton has been opened in the 560-ft. east workings and is being shipped to the mill. Cecil C. Morgan, Central City, is manager.

Illinois—Arrangements are being made

to work this property in Nevada district through the Newhouse tunnel at a depth of 1500 ft. with H. C. Bolsinger, Nevadaville, in charge. The vein was recently cut by the tunnel and is reported to be one of the most promising of the veins that has been cut in the tunnel.

Gilpin-Eureka—A strike of free gold ore in the 400-ft. level of the Eureka mine is reported. The streak, which is 6 in. wide, is alongside a free-milling body between 4 and 5 ft. in width. The company is figuring on erecting a mill. George W. Mabee, Central City, is manager.

Kansas-Burroughs—This group, comprising 14 claims on Quartz hill, Nevada district, has been merged and placed in hands of J. C. Jenkins and J. E. Lightbourn, of Central City, as trustees, with power to sell. The property has been idle for a number of years on account of water. This can be easily removed with lateral workings to the Newhouse tunnel at 1500 ft. depth.

Topeka—Plans are being drawn for a 100-ton amalgamating and concentrating mill at Black Hawk for the handling of the ores from the Topeka mines, Russell district. Henry P. Lowe, Central City, is manager.

LAKE COUNTY—LEADVILLE

Comstock—In the Hopemore claim, on Breece hill, adjoining the Ibex, the leasers have a sulphide orebody estimated at 75,000 tons, which shipments of carload lots proves to be worth from $10 to $11 per ton, but have had difficulty in marketing it at a profit. Now, however, it is stated that the local smeltery wants it, and that satisfactory treatment charges will be made, in which case 100 tons per diem will be produced.

Yak—The tunnel is past the No. 2 shaft of the Resurrection, and in blue limestone, and headed for the Diamond ground, about the center of the Big Evans amphitheater.

Lovejoy—The tunnel is now in 250 ft., and driving on a vein of ore said to carry 2 oz. gold per ton.

Gold Basin—The lessees on this Breece hill property are reported to have shipped a carload of ore carrying 10 oz. gold per ton.

Printer Boy—This mine, said to be the oldest in the district and idle now for a number of years, is being reopened under lease by a number of practical working miners.

New Jersey Zinc Company—This company is shipping 75 tons of zinc ore daily from the dumps of the A. Y. & Minnie, which tonnage is to be increased shortly.

Highland Mary—The shaft is down 125 ft. and from this point a drift was started south which after a few feet caught the orebody and it is now in ore. The values in the last oreshoot are better in gold and poorer in bismuth.

TELLER COUNTY—CRIPPLE CREEK

Lexington—The Nellie V. mine of this company, on Gold hill, is the scene of a surface strike, the veing being 3 ft. wide and the ore running $10 to $18 in gold without sorting.

Isabella—The day lease on Orphan Bell is shipping a 25-ton car very second day. A large tonnage of milling ore is developed in this mine and as so often happens, was found behind what was the supposed wall of the old Maloney vein, which produced great riches in the early days.

Maggie—Carl Johnson has been elected director of the company operating on Raven hill. The shaft is down 400 ft. and the property fully equipped. Two oreshoots have been opened.

Doctor-Jack Pot—Sherman M. Bell, leasing on the South End, has broken into what is apparently a new vein which runs over $100 across 3 ft. A small seam of oxidized calaverite is the main enriching feature. The new vein came in at 300 ft. depth.

Abe Lincoln—This is one of the Stratton properties which has produced phenomenal ore from time to time, and has just shipped a carload of ore yielding 4 oz. of gold to the ton and came from a winze below the 700 level.

Ben Hur—This mine, on Gold hill, is to be worked again under lease and through the Good-Will tunnel in Cottonwood gulch.

Idaho

COEUR D'ALENE DISTRICT

Mark Sullivan—C. L. Cowell, of Missoula, Mont., has secured control of the property. An electric compressor will be installed and development work prosecuted. Arthur Booth, Burke, Idaho, is in charge.

Hypotheek—The shaft is down 900 ft. When 1020 ft. has been reached a crosscut will be run 75 ft. to tap the vein.

Day—A contract has been let for a shaft on the property, at Falls creek, seven miles above St. Joe.

Reindeer—The drift is now in 250 ft., of which 240 ft. is in ore. The long tunnel on the property is in 3175 feet.

Coeur d'Alene North Fork—The concentrator was started Nov. 25. At present it is handling 75 tons daily, but its capacity is 200 tons.

Marsh—This group consists of five silver-lead claims near Burke. Charles Cowell, acting presumably for the Greenoughs, has closed a deal to secure the property for $150,000, and has made a payment of $25,000. Arthur A. Booth is in charge.

Imperial—The tunnel on the property near Mullan is in 1600 ft., and the management expects it to cut the vein 200 ft. ahead.

Coeur d'Alene Central—The lower tunnel is in 300 feet.

Snowstorm Extension—The drift on the principal ledge is in 800 feet.

Moonlight—A 3000-ft. tunnel is planned to tap the vein at 1500 feet.

WASHINGTON COUNTY

Gem State—This company is developing properties adjoining the Seven Devils district. The company will ship after Jan. 1 and is planning to erect a 100-ton concentrator in the spring. E. J. Winslow is general manager.

Illinois

SANGAMON COUNTY

Chicago-Virden Coal Company—Suit has been begun to foreclose the mortgage on this company's property. There are $600,000 bonds outstanding, the Pittsburg Coal Company and E. A. Wallace being the principal holders.

Indiana

CLAY COUNTY

A suit of importance to miners was decided in the Circuit Court at Brazil Dec. 8. Lawrence Kane sued the Miami Coal Company and recovered a judgment for $3000 for injuries received by falling slate while working in the company's mine. The company defended on the ground of negligence on the part of Kane in not notifying the company of the condition of the roof. The court held that the fact that Kane knew of the dangerous condition and worked away without notifying the company, is no defense when it is clearly shown that the company failed to make the place safe.

Maryland

Eagle Metallic Copper Company—The company operating at Charmain has let a contract for a mill to treat 200 tons daily.

Michigan

Michigan Quartz Silica Company—This company, mining quartz near Ishpeming, will install a plant at Milwaukee. The product, silica powder, is largely used by paint manufacturers. The plant at the mine will also be operated.

COPPER

Lake—The company has started the erection of a temporary rock house. A station is being cut at the sixth level preparatory to starting the crosscut to the lode, and as soon as this is finished drifting on the lode that was exposed in the shaft near the sixth level will be undertaken and the extent of the formation ascertained. Drifting on the main lode at the fifth level has been started in both directions near the hanging-wall side.

Isle Royale—Since the curtailment of development work and the centering of

all activity to the productive portions of the lode, resulting in a much better mineral return per ton of rock handled, this company is doing better than meeting current expense. Sinking at the Baltic shaft continues at 700 ft. The formation is changing.

Oneco—The Oneco lode has been encountered with the fourth drill hole, two drilling outfits, operating about 3500 ft. apart, are making a complete cross-section of the tract.

New Arcadian—No. 2 drill hole has encountered a copper-bearing amygdaloid lode at 75 ft. This lode was exposed in trenching.

Laurium—Sinking is going forward at 150 ft. on the lode and an encouraging showing is exposed. The surface equipment will soon be ready.

IRON

Catherine—This company, controlled by the Graham Bolt and Nut Company of Pittsburg, is operating in the Michigamme district and has been carrying on extensive explorations adjoining the Stewart mine.

Argyle Mining Company—A suit against the estate of Sigmund Rothschild, of Detroit, involving the property once held by the company in upper Michigan, has been brought by Don M. Dickinson to recover upward of $1,000,000 alleged to have been withheld from the stockholders.

Minnesota

Euclid—Preparations are being made to sink a new shaft on this property at Chisholm.

Missouri

Yellow Dog—This mine, at Joplin, has started up after a shutdown of several months. The north shaft has been dismantled and a new incline shaft driven to the south and connected to the mill with an inclined tram. The shaft will be operated with skips. One-half of the 1000-ton mill has been turned into a tailing mill and the other half will operate on the dirt from the ground.

Montana

BUTTE DISTRICT

Butte-Superior—The work of fitting the Basin concentrator to receive the company's ore has been begun. The contract calls for the treatment of 600 tons daily. At the Black Rock mine, surveys for the proposed mill and the spur are being made. On the 1600-ft. level a crosscut is being run south and is now in 165 ft. and three veins have been cut. Stoping has been begun south of the shaft on the 1200-ft. level and both east and west on the lead.

BROADWATER COUNTY

Three Forks—The shaft is down 250 ft., the last 30 ft. of which is in ore. A station will be cut when the 300-ft. mark is reached.

DEER LODGE COUNTY

Oro Fino—Charles Bergstrom has a lease on this property. The shaft is down 100 ft. and two cars weekly are shipped to Anaconda.

Butte-Anaconda Consolidated—Five men are working on the Golden Eagle on Flint creek. The tunnel is in 170 feet.

High-Grade—The shaft on the vein is down 175 ft. A drift from the bottom of the shaft has disclosed a vein 15 ft. wide.

Copper State—The shaft is down 65 ft. on the claims in Stuckey gulch.

JEFFERSON COUNTY

Corbin Copper—S. R. Dow, president, and R. M. Edwards, general manager, have recently made an inspection of the property. They announce that a 100-ton concentrator will be erected soon.

MADISON COUNTY

Apex—The Shafter mill at Summit is being overhauled and placed in readiness to start on ore from the Apex mine. W. T. Parkinson, C. R. Stranahan and Lee Taylor have a lease.

SANDERS COUNTY

A general revival has begun in mining in the Thompson region on the eastern slope of the Cœur d'Alene. The Thompson Mining and Milling Company, whose property has been idle for months, will resume. One of the tunnels is in 1000 ft. and shows in the face 2½ ft. of copper ore carrying good values. The property was formerly the Copper King. The Silver King, formerly the Buckeye, has already shipped a dozen cars of ore. The vein is 3 ft. wide and carries copper and silver. Development has been resumed after a shutdown. At the Paymaster group which adjoins the Silver King on the east, a drift on the vein has opened up high-grade silver-lead ore. A car of ore taken from the surface netted $400 to the owners of the Paymaster. Other shipments will be made soon.

Nevada

ESMERALDA COUNTY

Goldfield-Daisy—The Morrison lease upon the westerly block of the Daisy has recovered the rich sulphide vein, which was lost by the intrusion of a fault plane on the 360-ft. level.

C. O. D. Consolidated—This company has granted a five-year lease upon a portion of the Gold Bar claim to W. F. Grey. The lessee has agreed to construct a 50-ton mill on the property for the purpose of reducing the developed ores. Under the former management of the Gold Bar and C. O. D. properties ore to the extent of approximately $35,000 was shipped, the property then came into less experienced hands and the ore-shoot was lost at about the point it entered the sulphide zone. The present lessee is a practical miner of many years experience and it is expected that under his personal supervision the property will again assume the position it deserves among the large mines of the camp.

Montgomery-Shoshone—The net receipts have been as follows: June, $19,841; July, $15,544; August, $18,856; September, $15,316; October, $9193; November, $1079. The severe rains interfered with the operations in October and November. The bills payable Nov. 1 was $202,864.

Bullfrog-Mohawk—The new shaft at Pioneer has reached 110 ft. and it is the intention of the superintendent, J. H. Thomas, to continue sinking to 250 ft. before crosscutting.

Mayflower-Bullfrog—The 400-ft. level has entered the vein discovered in the upper workings, and from which such good returns were made. The vein is not so wide upon the lower level, but the grade has increased. H. S. Stark has resigned as manager and Jerry Rourke has been appointed his successor.

Nevada National—This company is developing the Dixie Extension claim in Paulsen cañon about twenty miles from Round Mountain. A tunnel is now in 65 ft. on the vein. Nels Paulsen is superintendent.

EUREKA COUNTY

George Wingfield has purchased the interests of Loftus & Davis in the new Buckthorn district, which promises to become a great low-grade camp. Large bodies of ore running from $10 to $12 per ton have been opened in a latite formation, such as is found in the deeper workings of the Goldfield district.

LYON COUNTY

The Silver City mills are shut down owing to the condition of the roads preventing the hauling of ore.

NYE COUNTY

The estimated production for the week ended Dec. 11, was $115,925, the tonnage being divided as follows: Tonopah, 2850; Tonopah-Belmont, 320; Montana-Tonopah, 957; MacNamara, 300; West End Consolidated, 120; Tonopah-Midway, 90; total, 4637 tons.

Tonopah—Preparations are being made to sink a new shaft upon the Sand Grass claim, the most westerly one of the company's acreage. The new shaft will be 2000 ft. west of the Red Plume shaft, at present the most westerly one, and a little northwest of the Tonopah Extension shaft. The shaft will be of three compartments and the skip ways will be 4½x 5 ft. in the clear, this shaft will be used as the central working point from which drifts and crosscuts will be run to fully develop the Sand Grass claim. The situation of this claim is favorable, end lining the Red Plume claim, and side lining one of the productive claims of the Tonopah Extension ground. The depth of the shaft will depend upon the geological con-

ditions. The diamond drill has been installed near the bottom of the Mizpah shaft at a depth of 1500 ft. and drilling is being steadily prosecuted.

Tonopah-Belmont—The east crosscut from the main shaft, at a depth of 1158 ft., has intersected the Belmont vein. The vein is six ft. wide and shows low-grade ore. Drifting will be started upon it immediately.

War Eagle Mill—This mill at Manhattan is preparing to run a lot of 500 tons of ore from the Stray Dog mine, and as soon as that is finished a lot of 400 tons will be run from the Rose-Nash lease upon the Union No. 4.

Round Mountain—During November the mill at Round mountain treated 2800 tons of ore, from which bullion having a value of about $35,000 was extracted. James R. Davis, the manager, estimates that 14,000 tons of ore has been added to the known ore reserves of the mine during the month.

STOREY COUNTY

Ophir—For the week ended Dec. 11, the mine extracted 427.89 tons of ore of an average value of $42.91 per ton. The winze being sunk from the 2200 level is down 37 ft. below the 2300 station.

Savage—This mine has completed milling its run of ore at the Sutro mill. The concentrates will be shipped to Selby.

Hale & Norcross—The mine has started a two-compartment raise from the north drift on the Sutro tunnel level.

C & C—The pumps have held the water at 148 ft. below the 2350 station.

Pennsylvania

The long drainage tunnel at the Oneider colliery, near Hazleton, has been completed and is now in use. The tunnel extends from the north basin of the mine to Little Tomhicken creek, is 4919 ft. long and 6x8 ft. in section. It was driven by the Portland Contracting Company under the supervision of Edgar Kudlick, division engineer.

LEBANON COUNTY

Cornwall Iron Mines—The Pennsylvania Steel Company, which already owned a controlling interest, has bought the Freeman interest, giving it practically the complete ownership of the Cornwall ore banks. Those are now the most important iron mines in Pennsylvania. The only other mines in the district are the North Cornwall ore banks, which are controlled by the Lackawanna Steel Company through ownership and through lease from the Coleman estate.

South Dakota

Homestake—The company has positively announced that it will not employ any members of the Western Federation of Miners. The company has suspended dividends and is concentrating work on the hydroelectric plant.

Continental—This company, operating near Keystone, in the Calumet district, has suspended the mining and smelting operations indefinitely in view of pending disturbances with the labor union. The company has issued an announcement that it will remodel its equipment and open up with nonunion labor as soon as possible.

Texas

From El Paso sources, it is reported that the International Smelting and Refining Company will erect a smeltery near El Paso. There is no official confirmation of the report.

Canada

NOVA SCOTIA

Springhill—These collieries, which have been idle since Aug. 10, when the miners belonging to the United Mine Workers went on a strike, were reopened on Dec. 13 when the Cumberland Railway and Coal Company brought a carload of foreign laborers from Montreal to take the places of the strikers. Other men will be brought in shortly.

ONTARIO—COBALT

The shipments for the week ended Dec. 10 were as follows: Nipissing, 192,242; Drummond, 190,000; La Rose, 129,681; Crown Reserve, 112,286; Temiskaming, 60,000; Kerr Lake, 61,890; total, 746,099 pounds.

Kerr Lake—A new shoot of high-grade ore has been struck on the fourth level.

O'Brien—High-grade ore has been found on the 75-ft. level 500 ft. from the No. 6 shaft.

Belmont—This company has started sinking on the main surface vein.

Paymaster—At this gold mine, Manitou Lake district, the 10-stamp mill is in operation.

Mexico

GUERRERO

Reforma—This property, near Balsas, is under option to the Exploration Company of London for a price said to be $10,000,000. The property is controlled by the Ortiz family of Mexico City and has been producing about $500,000 a year.

JALISCO

Lawson—The 30-ton custom reduction plant built in the Mascota district has been attached by creditors. Charles C. Clapp is in Jalisco to adjust the affairs of the company.

Carmen—This property at Cuale is under option to J. B. Wilson, of Cincinnati, and J. H. Lindenberger, of Louisville. for 50,000 pesos. It is the only mine now producing in the Cuale district.

MEXICO

Esperanza—In November, 13,983 tons of ore were milled and 6035 tons of tailings treated. The gross value of product was $206,424 and the net earning $91,106.

SONORA

Zambona—The plant, at present idle, is being overhauled and its capacity increased to 200 tons. It is near Alamos and is controlled by A. J. Yeager.

Promontorio—This mine has lately passed into the hands of the Clark Copper Company, of Los Angeles. It is reported to be rich in silver.

Lampazos—Funds for a recommencement of work have been subscribed. The mine lies near Moctezuma and is controlled by Michigan men.

El Temblor—T. E. Lambertson and R. L. Van Dusen have bonded this property to New York people.

Quintero—This mine, in the vicinity of Alamos, is operating a 10-stamp mill.

Espiritu Santo—Announcement of a resumption of work in January has been made. Development on a conservative scale will be attempted.

Africa

The Union Minière Du Haut-Kantanga is erecting a plant at the Star of Congo mine that is expected to be able to produce about 100 tons of copper per day.

Asia

COREA

Oriental Consolidated—Results for October; 220 stamps, running 29¼ days, crushed 28,557 tons; gross receipts, $121,607; operating costs, $63,646; operating profit, $57,960. The November cleanup amounted to $139,000.

INDIA—MYSORE

Kolar Goldfield—Gold production in November was 47,179 oz., being 75 oz. less than in October. For the 11 months ended Nov. 30, the total was 503,480 oz. bullion in 1908, and 508,570 oz. in 1909; an increase of 5090 oz. The bullion reported this year was equal to $9,460,928, or 457,713 oz. fine gold.

Australia

NEW SOUTH WALES

Broken Hill Proprietary Company—For the four weeks ended Nov. 24, the refinery turned out 516 oz. gold, 348,546 oz. silver, 6269 tons lead and 51 tons antimonial lead. Of these products 313,080 oz. silver and 5959 tons lead were from purchased ores. The mill produced 7778 tons zinc concentrates, containing 102,305 oz. silver, 496 tons lead and 3580 tons zinc.

WESTERN AUSTRALIA

Gold production in November is reported at 133,164 oz. fine, being 1955 oz. more than in October. For the 11 months ended Nov. 30, the total was 1,508,752 oz. in 1908, and 1,461,188 oz.—or $30,202,756—in 1909; a decrease of 47,564 oz. this year.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Dec. 22—Cold weather has been the chief factor of the coal market in the West. While steam coal remains steady, the domestic demand has materially enlarged, and mines are being called on for supplies to an extent that has put many mines on full time. Car shortage has affected the mines in southern Illinois, but east of that State there are few complaints.

In the East the bituminous trade is in better shape than for some time. Demand for coal is good and there is a tendency toward better prices than have prevailed. Transportation conditions are not good, car shortage being the general complaint.

The anthracite trade is good, chiefly owing to the cold weather.

The rainstorm of last week brought about a rise in the Ohio, and on Dec. 15 tows carrying 1,500,000 tons of coal came out of the Kanawha. Some of this coal had been stored over three months, waiting for a rise.

The conference over the Western bituminous agreement for next year will be held at Toledo, O., early in January. The present agreement will expire March 31, and a struggle over mining rates is probable.

Coal Traffic Notes

Coal tonnage originating on the Pennsylvania Railroad Company's lines east of Pittsburg and Erie, 11 months ended Nov. 30, short tons:

	1908.	1909.	Changes.
Anthracite	10,261,697	10,128,629	D. 133,068
Bituminous	32,352,198	35,283,701	I. 2,931,503
Coke	6,629,558	10,683,665	I. 4,054,107
Total	49,243,453	56,095,995	I. 6,852,542

The total increase for the 11 months this year was 13.9 per cent. The increase for the month of November was 875,441 tons, or 17.4 per cent.

The Colorado Fuel and Iron Company reports for the year ended June 30, 1909, a production of 4,094,352 short tons of coal, a decrease of 181,743 tons from the preceding year. The disposition of the coal last year was: Used at mines, 179,798 tons; used at coke ovens, 1,125,165; used in iron and other plants, 493,041; sold, 2,296,047; decrease in stocks, 301 tons. The coke produced was 645,545 tons, of which 477,913 tons were used in the company's plants and 167,632 tons were sold. The average consumption of coal was 1.74 tons to 1 ton of coke.

Coastwise shipments of coal from Atlantic ports, 10 months ended Oct. 31, long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York	11,711,474	8,725,597	20,437,071	60.7
Philadelphia	1,644,374	3,951,530	5,595,904	16.6
Baltimore	184,976	2,798,135	2,983,111	8.9
Newp't News	.....	2,933,104	2,933,104	8.8
Norfolk	.....	1,696,852	1,696,852	5.0
Total	13,540,824	20,105,218	33,646,042	100.0
Total, 1908.	14,328,421	18,915,045	33,243,466	.....

Total increase this year 242,576 tons, or 0.7 per cent. There was a decrease of 787,597 tons in anthracite. The gain in bituminous was almost entirely from Newport News and Norfolk, handling West Virginia coal.

New York

Anthracite

Dec. 22—Continued cold weather has brightened up the hard-coal market. Dealers are doing a heavy business, which is making the wholesale market more active. The recent storms have put an end for the time to the water troubles at the collieries, and most of them are working steadily.

Schedule prices for large sizes are $4.75 for lump and $5 for egg, stove and chestnut, f.o.b., New York harbor. For steam sizes quotations are, f.o.b., New York harbor points: Pea, $3.10@3.25; buckwheat, $2.35@2.50; No. 2 buckwheat or rice, $1.75@2; barley, $1.35@1.50. Some washery pea and buckwheat are offered at 10 or 15c. less.

Bituminous

The seaboard soft-coal trade is in fair condition, a moderate demand coming from all sections. There is little or no surplus at tidewater and deliveries are rather uncertain, owing to the difficulty in getting cars. Steam coal shows little change; in gas coal there is still a scarcity of slack and prices are variable.

Cars continue in short supply, especially on the Baltimore & Ohio; but shippers on the Pennsylvania and other lines are having their troubles also. Transportation is fair, coal coming through about on schedule time.

Ordinary grades of steam coal can be had at tidewater at prices equivalent to $1@1.05 at mines. Better grades command up to $1.40 at mines, with $1.50 for a few special coals.

In the coastwise trade vessels are inclined to hold back, though there has been no trouble yet from ice in the East. Rates on small boats are $1 per ton from Philadelphia to Boston, Salem and Portland; 70@75c. from New York to points around Cape Cod.

Birmingham

Dec. 21—Coal production is being rushed right now, to avoid any possible shortage from the holiday stoppage. There is a demand for all that is mined, and operations will be still more extended after January. Contracts have been let for the railroad extension to the new No. 13 mine which the Tennessee company is opening in the Pratt City district.

The demand for coke is very strong, and all that can be made is being used. Work is being rushed on repairing old ovens and building new ones.

Chicago

Dec. 21—Continued cold weather makes the demand for coal heavy and in consequence prices are very firm on Illinois and Indiana coals, the chief supply of this market. Lump and prepared sizes have no surplus coal on track and sales to escape demurrage on any kind of western coal are few. In the West and Northwest the intense cold has resulted in a rush demand for both bituminous and anthracite; retailers are ordering largely in the apparent belief that a cold winter is in sight. Apprehension of a spread of the switchmen's strike in the Northwest to other railway employees, with consequent tying up of traffic generally, is coöperating to bring orders from retailers who fear a shortage of supplies. Steam coals are selling more and more heavily.

Illinois and Indiana coals bring $2@3 for lump and egg, $1.75@1.85 for run-of-mine and 95c.@$1.25 for screenings.

Hocking is strongest of the coals from east of Indiana, and continues to bring $3.15. Smokeless is strong as regards lump and egg, with run-of-mine still somewhat weak because of oversupply. Pocahontas and New River lump and egg bring $3.65@3.75, and run-of-mine sells for about $3.05. Youghiogheny is somewhat active, with ¾-in. gas selling at $3.30. The continuance of cold weather benefits materially the market for eastern coals.

Cleveland

Dec. 20—Cold weather has kept the market for domestic coal strong. The steam-coal market is steady and is taking care of itself. Now the Lake trade is out of the way the car supply is fair, except for West Virginia, where there is complaint of a short supply and some difficulties in transportation. Prices are firm, with a general tendency to advance.

Indianapolis

Dec. 20—Conditions in the mining industry are the reverse of a few weeks ago. Every mine in the State in condition for operation is getting out as much coal as the force of men can send to the surface, working full time. There is no shortage of cars at any of the mines, and the roads promise to have all that may be called for during the remainder of the year. So far there has been no advance in prices at the mines. A considerable amount of the Indiana output goes to the Northwest, where the strike has been delaying freight traffic, but as yet but little complaint has come to Indiana operators. Indiana operators are advised that the Northwest failed to lay in a winter's supply of fuel during the fall and that the demand for coal from that section may be expected to continue all winter. The unexpected cold wave brought a rush of orders for coal and set into operation all the mines, many of which were working only about half-time during the warm November days. Coal operators are looking for an abnormal demand for coal during the remainder of the winter.

Pittsburg

Dec. 21—The local coal market continues firm, with prices unchanged. Current demand is good. There is some trouble over car shortage, but it is not serious. Prices remain strong at $1.15 for mine-run and nut, $1.25 for ¾-in. and $1.40 for domestic coal, with slack at 75@85c. per ton.

Connellsville Coke—Negotiations which were in progress last week on several furnace-coke contracts for next year have not come to a head and there is very little negotiating this week. There is scarcely any demand for prompt coke, and altogether the situation is, if anything, a trifle easier. Evidently consumers are well provided with stock-piles to cover the usual irregularities which are expected at this time on account of the men indulging in holiday festivities. In each of the three weeks ending Nov. 13, the production of the region was reported at over 450,000 tons, but the average of the succeeding four weeks has been about 435,000 tons, yet supplies seem to be adequate.

The market is quotable about 5c. lower than last week on furnace coke, standing about as follows: Prompt furnace coke, $2.75@2.80; contract, $2.75@2.85; prompt foundry, $3@3.25; contract, $3.25@3.50.

The *Courier* reports production in the Connellsville and lower Connellsville regions in the week ended Dec. 11, at 438,764 tons, and shipments at 4464 cars to Pittsburg, 7812 cars to points west of Pittsburg and 782 cars to points east of Connellsville, a total of 13,058 cars.

St. Louis

Dec. 20—The thermometer has hovered around about 20 deg. all week with the result that the coal market has been firm. Indications are that the thermometer will even go lower in the next couple of days as zero weather is predicted. The present cold spell is one of the longest and severest experienced in December in a good many years. While the retail yards report only a fair volume of business, yet the coal man has the satisfaction of knowing that householders' stocks are being depleted rapidly and that business will be much better in January and February on that account. The price of carload coal has been advanced 10 or 20c. per ton all down the line. The railroads are much tied up and cars are very short.

Screenings and lump went up at the same time and fine coal of all descriptions is exceedingly strong. Standard screenings are firm at 50c. at mine and several of the larger users here, such as the packing houses, were practically out of coal today. The fact that screenings and lump are both bringing good prices is netting the operator a good price for mine-run.

Since the Cherry mine disaster all the State inspectors have been very strict and a number of mines have been closed down part of the week for minor causes, such as not having the mine sprinkled or the roadway clean. Several operators who were closed down and immediately remedied the cause, were shut down three or four days extra because of delay in getting inspectors to reinspect and pass on the mine.

Quotations on Standard at mine are $1.25 for 6-in.; $1 for 3-in.; 70c. for steam nut; 50c. for screenings; freight to St. Louis, 52c. Staunton, Mt. Olive and Springfield, lump at mine, $1.50; nut, $1; screenings, 75c.; freight to St. Louis, 52c. Carterville, at mine, $1.75 for 6-in.; $1.40 for nut; 60c. for screenings; St. Louis prices 67c. higher. Franklin county $2 for 6-in. and $1.50 for nut at mine; St. Louis, 67c. more.

Washed coal in strong demand. St. Louis prices for No. 1 Standard are $2.42 @2.52; No. 2 $1.82; No. 3, $1.72; No. 4, $1.52; No. 5, $1.12. Washed Carterville 15c. higher on all grades, owing to difference in freight rate.

The anthracite situation has been relieved during the past week, as the cold weather has enabled wholesalers to clean up their surplus of grate and egg. The chestnut situation is bad and it looks very much as if there would be a chestnut famine here during January.

Foreign Coal Trade

Welsh Coal Market—Messrs. Hull, Blyth & Co., London and Cardiff, Wales, report prices of coal as follows on Dec. 11: Best Welsh steam, $4.02; seconds, $3.84; thirds, $3.66; dry coals, $3.84; best Monmouthshire, $3.48; seconds, $3.36; best small steam, $2.22; seconds, $1.86. All prices are per long ton, f.o.b. shipping port, for cash in 30 days, less 2½ per cent. discount.

British Coal Exports—Exports of fuel from Great Britain, with coal sent abroad for the use of steamships in foreign trade, 11 months ended Nov. 30, long tons:

	1908.	1909.	Changes.
Coal	57,375,422	57,748,100	I. 372,678
Coke	1,087,618	1,040,890	D. 46,728
Briquets	1,345,705	1,362,009	I. 16,304
Total exports	59,808,745	60,150,999	I. 342,254
Steamer coal	17,815,090	18,085,868	I. 270,778
Total	77,623,835	78,236,867	I. 613,032

The larger items of export were 9,541,360 tons to France, 8,868,169 to Germany, 8,412,854 to Italy and 3,621,603 tons to Sweden.

Iron Trade Review

New York, Dec. 22—The end-of-the-year quiet has settled down on the iron and steel markets generally, and little new business is being done. At the same time the mills report that specifications on contracts are coming in steadily and work is abundant.

In pig iron little is doing, except that some steel companies in the Central West are skirmishing still for outside lots of bessemer pig. So far as quotations are made, prices continue firm everywhere.

In finished material the only movement has been in some orders for steel cars and bridges from the railroads; and a few orders for steel rails. There are inquiries out for some good-sized orders for structural steel, but it is not expected that contracts will be closed before the end of the year. Jobbers almost everywhere report that small trade is in excellent shape.

Lake Superior Iron Ore—Iron-ore shipments from the Lake Superior region in December were 519,525 tons up to the final close of navigation. The complete water shipments for the season, as reported by the Cleveland *Iron Trade Review*, were 41,683,873 long tons; an increase of 16,256,779 tons over 1908, and of 395,118 tons over 1907, which was the record year up to this time. The division of shipments by ranges cannot yet be made. Rail shipments will have to be added to the water shipments above to make up the total. These were 587,893 tons in 1908, and probably about 850,000 tons this year.

Baltimore

Dec. 21—Imports for the week included 686 tons ferromanganese and 419 tons silicospiegel from Great Britain; 5700 tons manganese ore from Brazil; 20,950 tons iron ore from Cuba. Exports included 3,210,900 lb. steel plates, 382 tons steel rails and 16 tons rail fastenings to Vancouver, B. C.; 12,140 tons steel rails, 1108 tons rail fastenings and 718 tons tie-plates to Mexico.

Birmingham

Dec. 21—The Alabama iron market has been and is quiet so far as new business is concerned, but pig-iron makers express confidence that after Jan. 1 there will be takers for all the iron they can turn out. There are contracts for about all that will be made in the first quarter. The resale iron is nearly all out of the way now, and prices will not be affected by these lots, but will be on a steady basis, which most makers claim will be $15, Birmingham, for No. 2 foundry.

The flooding of the ore mines of the Sloss-Sheffield company on Red mountain has obliged that company to bank two of its blast furnaces, which are dependent on the supplies received daily. How long this will last is uncertain; it will take some time to unwater the mines, but ore may be secured elsewhere.

Judge Gary, of the United States Steel Corporation, has been inspecting the Tennessee Coal, Iron and Railroad Company's properties, in company with President Crawford and other officers of that company.

Chicago

Dec. 21—Quiet conditions continue in the iron market, with pig iron showing no decided upward or downward tendency in prices, but with Southern No. 2 in general selling at $14 Birmingham, whereas a week or two sales at that price were not the rule. This means $18.35 Chicago, and brings numerous small contracts for first-quarter delivery, with neither melters nor furnace agents anxious for more extended deliveries at this price, melters showing a feeling that it is well to proceed cautiously and sellers professing the belief that with the holiday season past the market will strengthen. Northern pig iron is firm at $18.50@19, the furnaces being well sold up. Some Southern is being sold at $14.50 Birmingham, for second-quarter delivery, but these contracts are neither numerous nor for large amounts. The market for iron and steel products continues moderately active, with large demand for structural steel. The railroads, though not active buyers, continue to manifest interest in present and prospective needs, while for plates, bars and other shapes there are fair to heavy sales. Notwithstanding occasional delays due to weather conditions, coke is in good supply at $5.50, Chicago.

Cleveland

Dec. 21—Ore prices are not settled yet, but there is a general belief in an advance of 50c. a ton. Some companies are making reservations of ore for the season, prices to be settled later.

Pig Iron—Some inquiries are coming in, chiefly for foundry and malleable. Current sales continue light. Prices are nominal, but there seems to be no disposition to make concessions.

Finished Material—The chief business has been in plates for shipbuilding. Inquiries are in for some large lots of bars. Jobbers report the small trade active in this district.

Philadelphia

Dec. 22—Pig iron is being shipped in large quantities from furnaces to customers. Deliveries are insisted upon according to contract. The only noticeable activity has been in malleable iron and quite a number of orders for small and large lots have been placed, nearly all of them for as quick delivery as can be made. A good deal of forging work is under way, in fact all the little concerns in that line are busy. Renewed inquiry has been made by pipe makers to cover some recently secured contracts, but as the iron will not be wanted until toward spring the inquiries, it is supposed, are merely sounding the market. Otherwise the crude-iron market is in its usual holiday quiet. Furnace people are quite confident of a renewal of demand in January. No. 2 X foundry is held at $19, and gray forge at $18, while $18 is asked for basic.

Steel Billets—The higher level of prices would be quoted if there were any inquiries, but consumers who will shortly need material are waiting until January.

Bars—All reports confirm the recent statements as to activity and strong prices. Quotations have been advanced on early deliveries and $1.80 is easily obtained. The manufacturers will enter the new year with heavier orders than they have had for two or three years.

Scrap—The scrap dealers are doing nothing. The only thing they are concerned about is to get supplies of railroad scrap and heavy melting scrap at prices which their prospective customers are willing to pay.

Pittsburg

Dec. 21—A firm tone prevails in the iron and steel market, although transactions are very light. The dullness is only seasonable, and no special activity is expected until well on in January. There is some good specifying on contracts which expire by limitation with the end of this month, as the prices are below the current market and buyers do not wish any tonnage canceled on them. Specifying is better on contracts for wire products, induced by the advance of $1 a ton made Dec. 11 last. Production is maintained at the full rate previously attained and there are no signs of any letting down in mill or furnace activity.

Pig Iron—The market is extremely dull, but prices are held. A sale of 1000 tons of basic was made last week, for first-quarter delivery, at $17.25, Valley, the recognized market for such delivery. Odd lots of prompt basic might be picked up at $17, Valley, as formerly. It is estimated that 30,000 tons of basic pig iron is held speculatively by three interests, but they have carried the iron for a long time and will only feed it out at good prices. The inquiry for 3000 to 4000 tons of bessemer iron for first-quarter delivery from a Cleveland steel-casting concern has not been acted upon yet. A fresh inquiry appeared this week for 5000 tons for first half from another interest, which is marked for closing Wednesday or Thursday of next week. Bessemer remains firm at $19, Valley. Foundry is quotable at $17@17.25, Valley, as formerly, depending on delivery, malleable being about 25c. higher and forge about 75c. lower.

Steel—There has been a slight further easing up in billets and sheet-bars for prompt shipment, billets being obtainable at $27, Pittsburg, and sheet-bars at $28.50, while for deliveries over first quarter or half, billets are $27.50@28 and sheet-bars $29.50@30. It is noticed that whereas open-hearth steel was at a premium over bessemer a few weeks ago it is now, if anything, easier than bessemer.

Ferromanganese—The market has been sluggish, with prices unchanged at $45@45.50, Baltimore, for prompt and $45.50@46 for first quarter or half, freight to Pittsburg being $1.95 per ton.

Sheets—Buying is not as heavy as it was, but the market is very strong, with mills sold up for more than half their prospective output in the first six months of the year. Prices remain at 2.40c. for black, 3.50c. for galvanized, $1.70 for painted corrugated and $3 for galvanized corrugated.

Foreign Iron Trade

British Iron Trade—Exports and imports of iron and steel and their manufactures in Great Britain, 11 months ended Nov. 30, as valued by Board of Trade returns:

	Exports.	Imports.	Excess.
Iron and steel	£34,780,368	£ 7,250,034	Ex. £27,530,334
Machinery...	25,925,063	4,099,017	Ex. 21,826,046
New ships....	5,660,509	.....	Ex. 5,660,509
Total..... ..	£66,365,940	£11,349,051	Ex. £55,016,889
Total, 1908..	73,310,614	11,227,453	Ex. 62,083,164

Decrease in exports, £6,944,674, chiefly in new ships; increase in imports, £121,598. The quantities of iron and steel were, in long tons:

	1908.	1909.	Changes.
Exports.....	3,786,699	3,850,559	I. 63,860
Imports.....	1,017,201	1,085,925	I. 68,724

Exports of scrap iron and steel, 117,362 tons in 1908, and 146,063 in 1909; increase, 28,701 tons.

British Iron Ore Imports—Imports of iron ore into Great Britain, 11 months ended Nov. 30 were 5,521,199 long tons in 1908, and 5,712,220 in 1909; increase, 191,021 tons. Of the imports this year 4,288,795 tons were from Spain.

Metal Markets

New York, Dec. 22—The metal markets remain steady, with comparatively few changes. In fact, matters have been inclined to dullness.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Oct. 1909..	$ 9,379,402	$ 7,034,164	Exp. $ 2,245,438
" 1908..	1,952,574	3,785,705	Imp. 1,833,131
Year 1909..	106,652,236	38,139,557	Exp. 68,512,679
" 1908..	70,889,954	42,213,678	" 28,676,276
Silver:			
Oct. 1909..	4,053,745	4,017,884	Exp. 35,861
" 1908..	4,378,015	3,746,863	" 631,652
Year 1909..	47,342,861	37,258,414	" 10,084,447
" 1908..	43,159,395	34,539,067	" 8,620,328

Exports from the port of New York, week ended Dec. 18: Gold, $521,500, chiefly to Brazil; silver, $874,450, largely to London. Imports: Gold, $130,248, mostly in bullion from Japan; silver, $256,104, principally from Mexico.

Gold—Prices on the open market in London were unchanged at 77s. 9d. per oz. for bars and 76s. 5d. per oz. for American coin. New York has sent more gold to South America.

Platinum—Business remains good and prices are unchanged, dealers asking $29.50 per oz. for refined platinum, and $35 per oz. for hard metal.

Our special correspondent writes from St. Petersburg, Russia, under date of Dec. 9 that the market shows a tendeney to be a little inactive. Some decrease in the demand from abroad has had an influence on the small dealers and producers at Ekaterinburg, who now sell crude metal, 83 per cent. platinum, at 6 rubles per zolotnik—equal to $22.56 per oz.—a decline of 25 kopeks. In St. Petersburg stocks are in strong hands, and 24,000 rubles per pood—$23.52 per oz.—is asked for crude metal.

Silver—Latest advices from India speak of good distribution of silver. Stock in London has been reduced to moderate dimensions and market is supplied at the advance to 24d. through the ordinary channels alone, so that it is reasonable to look for steadiness at current figures.

SILVER AND STERLING EXCHANGE

Dec.	16	17	18	20	21	22
New York....	52⅝	52⅝	52¾	52¾	52⅝	52⅝
London.....	24 3/16	24 3/16	24 5/16	24 1/16	24 1/16	24 3/16
Sterling Ex..	4.8790	4.8810	4.8810	4.8810	4.8810	4.8805

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Dec. 9, as reported by Messrs. Pixley & Abell:

	1908.	1909.	Changes.
India.....	£ 8,377,390	£6,094,000	D. £2,283,390
China.....	641,400	1,885,000	I. 1,243,600
Straits.....	164,885	114,600	D. 50,285
Total.....	£ 9,183,675	£8,093,600	D. £1,090,075

Indian Council bills in London sold at an average of 16.94d. per rupee.

Copper, Tin, Lead and Zinc

Dec.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
16	13⅜ @13¾	13⅜ @13⅜	59⅞	33	4.60	4.47½ @4.52½	6.07½ @6.10
17	13⅜ @13¾	13⅜ @13⅜	59⅞	33	4.60	4.47½ @4.52½	6.05 @6.10
18	13⅜ @13¾	13⅜ @13⅜	....	33	4.60	4.50 @4.55	6.05 @6.10
20	13⅜ @13⅞	13⅜ @13⅜	60	34	4.60 @4.70	4.55 @4.60	6.02½ @6.07½
21	13⅜ @13⅞	13⅜ @13⅜	60⅛	33⅞	4.70	4.60 @4 65	6.00 @6.05
22	13⅜ @13⅞	13⅜ @13⅜	60⅛	33¾	4.70	4.60 @4.65	6.00 @6.05

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—There has been more business both for Lake and electrolytic copper. Manufacturers are busy and orders are coming in at a satisfactory rate. The demand has been freely met at current quotations. The market closes firm at 13⅜@13⅞c. for Lake, and 13¼@13⅜c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 13@13¼ cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 15¼c. base, carload lots at mill. Business is fair.

The standard market in London developed further strength and more confidence is shown abroad in the position of the metal. The market has been active at somewhat higher prices, and closes at £60 5s. for spot and £61 7s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £62 10s.; best selected, £62 10s. @ £63 10s.; strong sheets, £73 10s. @ £74 10s. per ton.

Exports of copper from New York and Philadelphia for the week were 5475 long tons. Our special correspondent gives exports from Baltimore at 1129 tons copper.

Tin—The bull syndicate in the London market has been very successful and prices have been advanced rapidly. While the market at the end of last week remained steady, Monday of this week witnessed an advance of somewhat over £4 under very heavy transactions. Subsequently, there was some easing off, brought about, no doubt, by realization of speculative holdings, and the close is cabled as easy at £153 7s. 6d. for spot and £154 12s. 6d. for three months.

Notwithstanding the excitement in the London market, domestic interests kept cool, especially consumers, who held back with purchases. There was some business between dealers and importers from day to day, quotations being made at about 33¾c. per pound.

Messrs. Robertson & Bense report arrivals of Bolivian tin ore (concentrates) at Hamburg in November at 995 long tons; 129 tons direct and 866 tons through other ports.

Lead—There has been an excellent demand for this metal and the market is strong. On Monday, the leading sellers advanced the price further to 4.70c.. There has been a large demand for Western lead. The close is firm at 4.60@4.65c. St. Louis, and 4.70c. New York.

The London market is also firmer and the close is cabled at £13 2s. 6d. for Spanish lead, and £13 5s. for English.

Spelter—The market is dull and quiet. There has been little demand. Prices have eased off, closing nominally at 6@6.05c. St. Louis, and 6.15@6.20c. New York.

New York quotations for spelter on Dec. 16 were 6.22½@6.25c.; Dec. 17 and 18, 6.20@6.25c.; Dec. 20, 6.17½@6.22½.; Dec. 21 and 22, 6.15@6.20 cents.

The London market is unchanged at £23 2s. 6d. for good ordinaries, and £23 7s. 6d. for specials.

Base price of sheet zinc is now 8c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Antimony—The market remains quiet, with only a retail business doing. The prices are nominally unchanged. Cookson's is quoted at 8⅜@8½c. per lb.; Hallett's, 8@8⅛c.; U. S., 7⅞@8c.; with 7⅝@7¾c. named for outside brands.

Aluminum—The price of aluminum is unchanged at 20@23c. per lb. for ingots. The higher price is that asked by the American producer.

Quicksilver—The market continues good, and prices are steady. In New York the quotation is $52.50 per flask of 75 lb. for large lots; for small lots 72@75c. per lb. is asked by jobbers. The San Francisco quotation is $50.50@51.50 per flask for domestic orders, and $2 less for export. The London price is £9 15s. per flask, with £9 17s. 6d. asked by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot, from 50c. for 2000-lb. lots, up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots f.o.b. New York.

Cadmium—Current quotations are 65@70c. per lb. in 100-lb. lots at Cleveland, Ohio. In Germany 450@475 marks per 100 kg., at factory in Silesia.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, 11 months ended Nov. 30, figures in long tons, except quicksilver, which is in pounds:

Metals:	Imports.	Exports.	Excess.
Copper, long tons	158,733	57,798 Imp.	100,935
Copper, 1908....	155,159	63,304 Imp.	91,855
Tin, long tons....	38,019	37,661 Imp.	358
Tin, 1908.....	42,946	38,361 Imp.	4,585
Lead, long tons..	189,090	42,220 Imp.	146,870
Lead, 1908.....	216,811	46,539 Imp.	170,272
Spelter, l'g tons..	108,496	10,258 Imp.	98,238
Spelter, 1908....	97,854	8,508 Imp.	89,346
Quicksilver, lb...	3,169,061	1,567,087 Imp.	1,601,974
Quicksilver, '08	3,228,092	1,600,175 Imp.	1,627,917
Ores:			
Tin ore and con.	21,964	Imp.	21,964
Tin ore, 1908...	22,888	Imp.	22,888
Pyrites.....	701,869	Imp.	701,869
Pyrites, 1908...	709,329	Imp.	709,329

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Of the imports in 1909 the United States furnished in all 209 tons copper matte, 64,460 tons fine copper and 29,963 tons lead. This lead was chiefly Mexican, refined in this country.

Zinc and Lead Ore Markets

Platteville, Wis., Dec. 18—The base price paid this week for zinc ore was $49@50 per ton; no premium price is reported. The highest price paid for lead ore was $58.80 per ton; the base price was $54@56 per ton.

SHIPMENTS, WEEK ENDED DEC. 18.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Cuba City.....	496,675	173,878	261,675
Platteville.....	390,160	.....	289,500
Mineral Point...	370,000	.....	.....
Benton.....	323,350	64,950	.....
Highland.....	246,700	.....	.....
Days Siding.....	86,400	.....	.....
Shullsburg.....	75,000	.....	.....
Harker.....	65,370	.....	.....
Montfort.....	60,000	.....	.....
Linden	58,550	.....	.....
Livingston.....	.....	64,000	.....
Total.....	2,172,205	302,828	551,175
Year to Dec. 18.....	132,879,580	9,220,483	15,441,910

In addition to the above there was shipped to the separating plants, Platteville, Galena and Mineral Point, 2,210,325 lb. zinc concentrates. Shipments were largely reduced on account of car shortage.

Joplin, Mo., Dec. 18—The highest price paid for zinc-sulphide ore was $53, the base being $48@50 per ton of 60 per cent. zinc. Zinc silicate sold at $27@28 per ton of 40-per cent. zinc. The average price, all grades, was $48.02 per ton. The highest price paid for lead was $56 per ton of 80 per cent. metal content, a few bins commanding $58. The average price, all grades, was $55.64 per ton.

The lower price did not deter the majority of producers from selling their zinc ore, as the shipment is an increase over last week, while a number of producers sold an accumulation of lead ore at the advanced price. The drop in the zinc-ore market is a repetition of what occurs during December every year, and if January repeats itself prices will be up again the middle of next month. Many mines that use hand work in ore concentration have been able to produce but lightly this month on account of the unusual severity of the weather.

SHIPMENTS, WEEK ENDED DEC. 18.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,967,440	706,120	$116,973
Joplin.....	1,682,690	494,070	57,742
Prosperity.....	685,550	226,350	23,132
Duenweg.....	596,900	75,660	16,742
Galena.....	484,290	78,630	14,067
Miami.....	193,290	316,600	12,765
Oronogo.....	325,480	81,810	10,672
Alba-Neck.....	385,530	5,620	9,792
Quapaw.....	204,410	54,920	8,531
Sarcoxie.....	317,290	.....	7,329
Aurora.....	404,450	18,510	7,281
Spurgeon.....	257,860	64,330	6,179
Zincite.....	182,740	37,320	5,666
Carthage.....	221,070	.....	5,526
Granby	286,490	5,700	5,495
Badger.....	158,940	15,360	4,663
Wentworth.....	114,910	.....	2,749
Stott City.....	48,240	.....	1,158
Peoria.....	58,010	.....	870
Totals	10,685,580	2,181,000	$317,332
51 weeks.....	580,504,230	86,307,930	$14,267,942
Zinc value, the week, $256,644; 51 weeks,			$11,914,170
Lead value, the week, 60,688; 51 weeks,			2,353,772

MONTHLY AVERAGE PRICES.

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February....	36.63	36.94	34.92	34.37	49.72	50.50
March.....	36.19	37.40	34.19	34.71	49.90	50.82
April.....	35.40	38.63	34.08	37.01	52.47	55.63
May.....	34.19	40.06	33.39	37.42	56.05	56.59
June.....	33.06	44.15	32.07	40.35	60.48	57.52
July	34.55	43.06	31.67	41.11	59.90	53.74
August	36.53	48.25	33.42	44.54	60.34	57.60
September ..	37.63	47.70	34.44	44.87	54.59	56.11
October.....	35.95	49.50	33.28	45.75	52.63	55.02
November...	39.13	51.31	35.02	48.29	54.53	53.94
December...	42.75	.....	39.63	.....	49.68	.....
Year.....	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Petroleum

Exports of petroleum from the United States, 11 months ended Nov. 30, in gallons:

	1908.	1909.
Crude petroleum.....	89,211,233	133,262,458
Naphthas.....	33,172,881	54,185,019
Illuminating oil.....	1,032,186,908	958,041,638
Lubricating and paraffin..	132,664,633	141,753,575
Residuum.....	66,678,811	87,691,329
Total.....	1,353,914,466	1,374,934,019

The total increase this year was 21,019,553 gal., or 1.6 per cent.

Chemicals

New York, Dec. 22—The New York chemical market is a little more active and prices are firm at rather higher figures than last week.

Copper Sulphate—Quotations are higher at $4.10 per 100 lb. in carload lots and $4.35 per 100 lb. for smaller sales.

Arsenic—Some inquiries are being heard, and although there is little active business, dealers still hold at 2¾@2⅞c. per lb. for white arsenic.

Nitrate of Soda—The market for nitrate is firm now at 2.10c. per lb. in all positions; a slight increase for spot.

Potash Salts—Berlin despatches report that the Kali Syndikat will probably come to terms with the owners of the Schmidtmann group of mines which holds the contracts with the American companies, the execution of which led to the recent disruption of the syndicate. A provisional agreement by which the syndicate will be let in on the American contracts has been signed and it is expected that it will be ratified at a general meeting of the syndicate. Schmidtmann has sailed for America to secure the assent of the holders of the contracts. A further despatch says that the Prussion government has submitted to the Federal Council a bill placing all the potash mines under Imperial control, to take effect in two years.

Mining Stocks

New York, Dec. 22—It has been mainly a traders' market on the Stock Exchange this week. There were advances early in the week and recessions at the close. Steel stocks were less prominent, the market inclining to specialties. Anthracite-coal stocks are still prominent.

There was one sale of Homestake, of South Dakota, early in the week at $79.87½; a later sale was at $80.12½ per share.

The Curb was not specially active, and was rather uncertain as to copper stocks, some advancing and some declining. Miami was the strongest and most active.

The American Cement Company has declared a semi-annual dividend of 1 per cent. Last July 3 per cent. was paid, making 4 per cent. for 1909, against 6 in 1908 and 7 in 1907. The effect of the dividend was a drop of $13.75 per share.

Boston, Dec. 21—The market for copper shares has been extremely active and broad, with an upward tendency throughout. Brokers are almost overwhelmed with customers and an old-time market seems to be here. Interest has come back, chiefly to Lake Superior stocks, but it is not confined to them, taking in other copper districts as well. The new developments at the Lake are closely watched.

Lake was a leader in the market and on large sales was up today to $74.12½, with a slight recession, to $73.25. Hancock reached $35.50, losing only 50c. of the advance. Keweenaw also recorded a substantial gain. Mohawk advanced $2, to $65; while Isle Royale, quiet for some time, appeared quite prominently in the trading. There was a general firmness in all the Lake coppers, with heavy trading.

North Butte touched $56.50, closing $1 less. East Butte sold at $13.25, on heavy trading. Boston Consolidated also sold well, with a high price of $22.50. Amal-

gamated was between $87 and $88 per share.

The Curb was busy with heavy trading in almost all its recognized specialties. A new stock appeared in New Baltic, the organization of which is just completed; it sold today at $10@10.25 per share. Boston-Ely and Cactus were other features in the trading today.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
I	112,135,200	51,862,624	38,499,797
II	103,700,817	43,578,118	30,968,496
III	117,058,661	48,871,964	59,191,043
IV	113,574,292	47,546,010	65,110,111
V	118,356,146	61,163,325	70,542,753
VI	116,567,493	60,591,116	70,966,457
VII	118,277,603	75,520,083	75,018,974
VIII	120,597,234	59,614,207	48,382,704
IX	118,023,139	52,105,955	50,077,777
X	124,657,709	66,359,617	56,261,238
XI	121,618,369	66,857,873	55,266,595
XII			

VISIBLE STOCKS.

	United States.	Europe.	Total.
I	122,357,266	124,716,480	247,073,746
II	144,130,045	118,574,400	262,704,445
III	173,284,248	117,140,800	290,425,048
IV	182,279,902	115,024,000	297,303,902
V	183,198,073	114,050,320	297,248,393
VI	169,848,141	127,352,960	297,201,101
VII	154,858,061	150,928,960	305,787,021
VIII	122,596,607	171,492,160	294,088,767
IX	135,196,930	197,993,600	333,190,530
X	151,472,772	210,224,000	361,696,772
XI	153,509,626	222,566,400	376,076,026
XII	153,003,527	236,857,600	389,861,127

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

Monthly Average Prices of Metals

SILVER

Month.	New York. 1908.	New York. 1909.	London. 1908.	London. 1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.428	25.133	23.708
May	52.795	52.905	24.377	24.343
June	53.663	52.538	24.760	24.166
July	53.115	51.043	24.514	23.519
August	51.683	51.125	23.858	23.588
September	51.720	51.449	23.877	23.743
October	51.431	50.923	23.725	23.502
November	49.647	50.703	22.933	23.351
December	48.766	.....	22.493	...
Total	52.864	.....	24.402	

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

Month.	NEW YORK. Electrolytic 1908.	Electrolytic 1909.	Lake. 1908.	Lake. 1909.	LONDON. 1908.	LONDON. 1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56⅛	12.928	12.93⅜	58.331	57.363
May	12.598	12.893	12.788	13.238	57.387	59.338
June	12.675	13.214	12.877	13.548	57.842	59.627
July	12.702	12.880	12.933	13.363	57.989	58.556
August	13.462	13.007	13.639	13.296	60.500	59.393
September	13.388	12.870	13.600	13.210	60.338	59.021
October	13.354	12.760	13.646	13.030	60.139	57.551
November	14.130	13.125	14.386	13.354	63.417	58.917
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January	27.380	28.060	July	29.207	29.125
February	28.978	28.290	August	29.942	29.966
March	30.577	28.727	September	28.815	30.293
April	31.702	29.445	October	29.444	30.475
May	30.015	29.225	November	30.348	30.859
June	28.024	29.322	December	29.154	.....
			Av. year	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York. 1908	New York. 1909.	St. Louis 1909.	London. 1908.	London. 1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	4.287	4.214	12.938	13.225
June	4.466	4.350	4.291	12.600	13.031
July	4.744	4.321	4.188	13.000	12.563
August	4.580	4.363	4.227	13.375	12.475
September	4.515	4.342	4.215	13.125	12.781
October	4.351	4.341	4.215	13.375	13.175
November	4.330	4.370	4.252	13.538	13.047
December	4.213	.....	.....	13.166	.....
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York. 1908.	New York. 1909.	St. Louis. 1908.	St. Louis. 1909.	London. 1908.	London. 1909.
January	4.518	5.141	4.363	4.991	20.563	21.225
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	5.124	4.458	4.974	19.906	21.975
June	4.543	5.402	4.393	5.252	19.000	22.000
July	4.485	5.402	4.338	5.252	19.031	21.969
August	4.702	5.729	4.556	5.579	19.350	22.125
September	4.769	5.796	4.619	5.646	19.563	22.906
October	4.801	6.199	4.651	6.043	19.750	23.200
November	5.059	6.381	4.909	6.231	20.875	23.188
December	5.137	.....	4.987	.....	20.625	.....
Year	4.726	.....	4.578	.....	20.163	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

STOCK QUOTATIONS

NEW YORK Dec. 22 Name of Comp.	Clg.	BOSTON Dec. 22 Name of Comp.	Clg.
Amalgamated	.88¾	Adventure	7
Anaconda	.50⅛	Allouez	56
Balaklala	2⅛	Am. Zinc	39⅜
Braden	4⅞	Arcadian	8¼
British Col. Cop.	8	Arizona Com	47⅞
Buffalo Mines	3½	Atlantic	13
Butte Coalition	29½	Boston Con	22¼
Colonial Silver	7/16	Calumet & Ariz	102
Combination Fra.	.46	Calumet & Hecla	666
Con. Ariz. Sm.	2 5/16	Centennial	38½
Cum. Ely Mining	9	Con. Mercur	.12
Davis-Daly	4½	Copper Range	82½
Dominion Cop.	7	Daly-West	8¾
El Rayo	2⅞	East Butte	12⅞
Florence	2¾	Franklin	17
Furnace Creek	.05	Greene—Can	11¾
Giroux	11¼	Hancock	34¾
Gold Hill	2	Isle Royal	28¼
Goldfield Con	8⅛	Keweenaw	6½
Granby	107	La Salle	17½
Guanajuato	2	Mass	7
Guggen. Exp	255	Michigan	7½
Hanapah	15	Mohawk	65
Kerr Lake	8¼	Nevada	26¾
McKinley-Dar.	.88	North Butte	55¾
Miami Copper	22¼	Ojibway	9
Mines Co. of Am.	.48	Old Dominion	.54¼
Montezu. of C. R.	4	Osceola	162½
Mont. Sho. C	1⅜	Parrot	28¼
Nev. Utah M. & S.	1 1/16	Quincy	87
Newhouse M. & S.	‡3½	Rhode Island	‡10½
Nipissing Mines	10⅞	Shannon	16½
Ohio Copper	6	Superior	6
Old Hundred	⅛	Superior & Bost.	17¼
Pacific Sm. & M.	1⅞	Superior & Pitts.	16½
Silver Queen	.25	Tamarack	70
Stewart	7/16	Trinity	9¾
Tennessee Cop'r.	38¾	U. S. Smg. & Ref.	54
Tri-Bullion	1/16	U.S.Sm. & Re., pd.	53
United Copper	8¼	Utah Con	45⅞
Utah Apex	5⅛	Victoria	4½
Utah Copper	60¾	Winona	11
Yukon Gold	4⅞	Wolverine	146
		Wyandotte	3

‡Last quotation. ‡Last quotation.

N. Y. INDUSTRIAL

Am. Agri. Chem.	47
Am. Smelt. & Ref.	101¾
Am.Sm. & Ref., pf.	‡112
Colo. Fuel & Iron.	50⅝
Federal M. & S.,pf.	87¼
National Lead	89⅛
National Lead, pf.	‡110¼
Pittsburg Coal	27½
Republic I. & S.	46⅛
Republic I. & S.,pf.	104¾
Sloss-Sheffield	‡87½
Standard Oil	666
U. S. Steel	91⅜
U. S. Steel, pf.	124⅞
Va. Car. Chem.	51⅝

BOSTON CURB

	Low.
Ahmeek	225
Chemung	14
Chino	11⅛
Gila	9⅝
Indiana	7⅞
Mason Valley	2
Ray Central	3¼
Ray Con	25⅜
San Antonio	9½
Yuma	1½

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Dec. 18

N. of Com.	High.	Low.
Adams	.40	.30
Am. Nettie	.09	.07
Center Cr'k	2.00	1.75
Cent.C.& C.	87.00	86.00
C.C. & C. pf.	85.00	84.00
Cent. Oil	115.00	100.00
Columbia	9.00	7.00
Con. Coal	18.00	17.00
Doe Run	115.00	100.00
Gra. Bimet.	.35	.30
St. Joe	12.50	11.00

LONDON Dec. 22

Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 3 3
Camp Bird	1 8 6
Esperanza	2 15 0
Tomboy	1 0 0
El Oro	1 6 9
Oroville	0 10 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Dec. 22.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Bid.	Name of Comp.	Bid.
COMSTOCK STOCKS		Silver Pick	.08
Belcher	1.15	St. Ives	.05
Best & Belcher	.84	Triangle	‡.01
Caledonia	.64	BULLFROG STOCKS	
Challar	.32	Gibraltar	‡.02
Comstock	‡.30	Homestake King	‡.01
Con. Cal. & Va	1.55	Mont. Shoshone C.	1.25
Crown Point	.99	Tramp Cons	.04
Exchequer	.43	MISCELLANEOUS	
Gould & Curry	.43	Cumberland Ely	8.00
Hale & Norcross	.55	Giroux	11.25
Mexican	1.85	Greenwa'r Copper	.08
Ophir	2.00	Nevada Con	26.75
Overman	.67	Nevada Hills	.70
Potosi	.64	Nevada Smelting	1.00
Savage	.55	Nevada Wonder	.60
Sierra Nevada	.63	Nevada-Utah	1.25
Union	.88	Penn-Wyoming	...
Utah	.11	Pittsburgh S. Pk.	.81
Yellow Jacket	1.35	Ray Central	3.37½
TONOPAH STOCKS		Ray Con	25.00
Belmont	.18	Round Mt. Sphinx	‡.05
Extension	.69		
Golden Anchor	...		
Jim Butler	.09		
MacNamara	.28		
Midway	.25		
Montana	.85		
North Star	‡.02		
Tono'h Mine of N.	7.43¾		
West End Con	.28		
GOLDFI'D STOCKS			
Adams	‡.01		
Atlanta	.10		
Blue Bell	.02		
Booth	.08		
C.O.D. Con	.06		
Columbia Mt.	.05		
Comb. Frac.	.45		
Cracker Jack	.01		
Dia'dfield B. B. C.	.01		
Florence	2.62½		
Goldfield Belmont	.04		
Goldfield Daisy	.09½		
Great Bend	.03		
Jumbo Extension	.11		
Kendall	.03		
Lone Star	.03		
May Queen	.04		
Oro	.02		
Red Hill	.03		
Sandstorm	.05		

COLO. SPRINGS Dec. 17

Name of Comp.	Clg.
Acacia	‡.07¾
C. C. Con	.03½
Dante	.07½
Doctor Jack Pot	.07½
Elkton	.69
El Paso	.63
Findlay	.10¼
Gold Dollar	.10½
Gold Sovereign	.04¾
Isabella	.19
Jennie Sample	.08
Jerry Johnson	.08¼
Lexington	.48½
Mary McKinney	‡.48
Old Gold	.04½
Pharmacist	.03½
Portland	.86
U. G. M.	.10¼
Vindicator	.75
Work	‡.06½

Assessments

Company.	Delinq.	Sale.	Amt.
Adventure Con. Cop., Mich.	.....	Feb. 1	$1.00
Arcadian Copper, Mich.	.....	Mar. 1	0.50
Boston Ely, Nev.	Dec. 23	.....	0.50
Camp Bird Min. Co., Colo.	Dec. 13	.....	0.002
Chemung Copper, N. M.	Jan. 1	Jan. 2	1.00
Con. Imperial, Nev.	Jan. 11	Feb. 3	0.01
Con. Virginia, Nev.	Dec. 20	Jan. 10	0.25
Exchequer, Nev.	Dec. 15	Jan. 5	0.05
Gordon M. & M., Utah	Jan. 15	Feb. 4	0.002
Hancock Min., Mich.	.....	Feb. 1	1.00
Mineral Flat, Colo.	Dec. 11	Jan. 6	0.01
Mountain Dell Con., Utah	Dec. 21	Jan. 10	0.01
Palmyra G. & C., Utah	Dec. 29	Jan. 19	0.002
Reindeer C. & G., Ida.	Dec. 31	Jan. 19	0.003
Seven Bros.-Pioche, Nev.	Jan. 15	Feb. 4	0.002
Sierra Nevada, Nev.	Jan. 11	Feb. 3	0.10
Silver Hill, Nev.	Dec. 23	Jan. 14	0.05
Silver King Con., Utah	Jan. 17	Feb. 5	0.10
Union Con., Nev.	Dec. 22	Jan. 13	0.10
Utah Ideal, Utah	Feb. 1	Feb. 20	0.00½
Winona, Mich.	Dec. 1	Jan. 1	1.00

$5.00 per Year. DECEMBER 25, 1909.

GENERAL LIBRARY,
UNIV. OF MICH.,
DEC 29 1909.

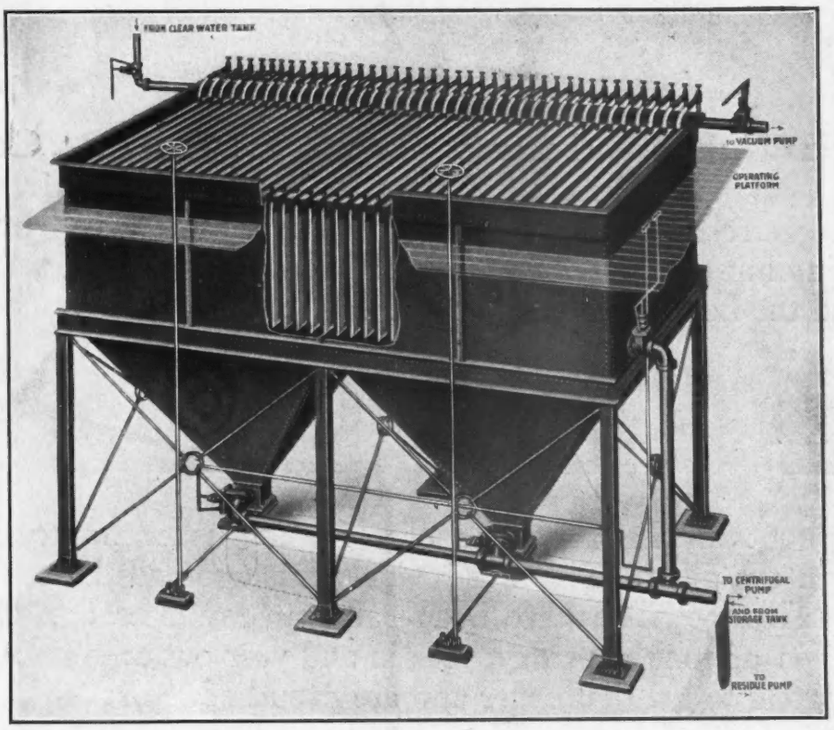
THE ENGINEERING AND MINING JOURNAL

Vol. 88. 505 Pearl Street, New York. No. 26.

Contents, 1275. Index to Advertisers, 40. Buyers' Directory, 42. Professional Directory, 64.

BUTTERS FILTERS

MEAN NO RISK OF FAILURE



For Simplicity the **Butters Filter** appeals to every operator. Any unit may be removed and replaced in less than **2 minutes** without interfering with the working of the others.

See Our Other Advertisement on Page 15.

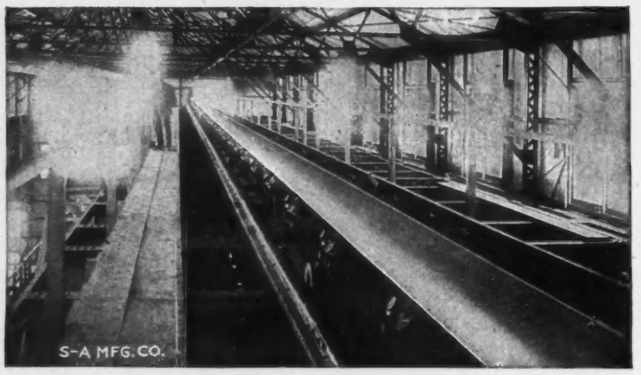
The Butters Patent Vacuum Filter Co., Inc.,

333 Kearny Street, San Francisco, Cal.
30 Church Street, New York } **Cable: Butters.**
Gante 1, Mexico, D. F.

54 New Broad Street, London, E. C. Cable: Armisonus.

AGENTS—Fraser & Chalmers, London and Branch Offices, Paris, Johannesburg, Bulawayo, Sekondi, Singapore, Montreal, Valparaiso and elsewhere. Fried. Krupp, A. G., Grusonwerk; Magdeburg, Germany, and Representatives in London, Montreal, Salisbury, Rhodesia and elsewhere. The Sandycroft Foundry Co., London and Chester, England.

Stephens-Adamson Mfg. Co.



THEN there is the great plant of the **Detroit Copper Mining Co., of Arizona,** designed by Mr. H. K. Burch. Did the owners try to skimp or "save" by using anything but the best in this plant? **Not by any means,** they wanted the best and they got it. They put in

"S-A" Belt Conveyors

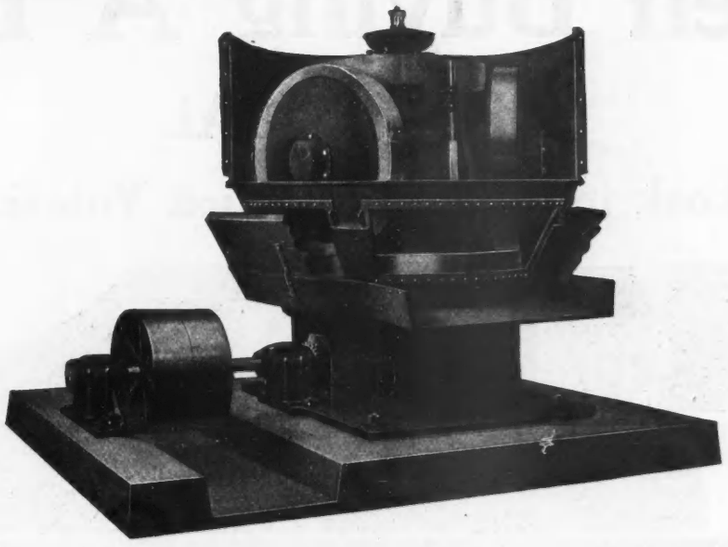
throughout for handling the ores from crusher house and all through the plant. This was several years ago and those **"S-A" Belt Conveyors** have been running day after day carrying hundreds of tons each day, year in and year out ever since. We were proud to get that order and are proud of the record.

We are building them even better today than we did then, and now **"S-A" Belt Conveyors** are recognized as the standard by which others are judged. If you want your plant fitted with the best, insist on having **"S-A" Belt Conveyors.** We publish a catalog of 672 pages and also issue bulletins frequently, describing our line of Conveying and Elevating Machinery.

Main Office and Works, Aurora, Ill., U. S. A.

Branch Offices: - - Chicago and New York City.

CHALMERS & WILLIAMS



PATENTS PENDING

Automatic Chile Mill

We have so constructed this mill that the adjustment of the driving center is automatic, as the position of the rollers vary with the wear of the die and tires. It is especially designed for use in concentration works for the regrinding of jig tailings and middlings for further treatment.

BUILT IN FOUR SIZES—4 ft., 5 ft., 6 ft. and 7 ft.

Write for descriptive Catalog.

General Offices, 1925 Commercial Nat'l Bank Bldg., Chicago

New York Office, 120 Liberty Street,
Salt Lake Agents, R. J. Glendinning & Co.
San Francisco Agents, Hewitt Machinery Co.

MINING MACHINERY
GENERAL OFFICES - CHICAGO
WORKS - CHICAGO HEIGHTS, ILL.

THE PIONEER MINING MACHINERY HOUSE OF THE WEST.

THE HENDRIE & BOLTHOFF MFG & SUPPLY CO.

DENVER, COLO.

STEAM ELECTRICAL AND HYDRAULIC ENGINEERING ~ MINE AND SMELTER SUPPLIES.

When Buying A Hoist

BE CRITICAL

Look into the Constuction Yourself

It Means Dollars To You

We invite inspection and comparison. H. & B. VULCAN HOISTS ARE BUILT IN LOTS IN A SHOP EQUIPPED WITH THE BEST MODERN TOOLS.

Compare the size of gears, shafts, brakes, clutches and above all the actual weight. Our proposals give all of these details, and on this basis only can a proper comparison be made.

Our hoists are built by machinists. [No apprentices in the shops] The design and improvements are original and found exclusively on Vulcan hoists.

Send for the

"Hoist Question"

A 64 page fully illustrated catalog—Write to-day.

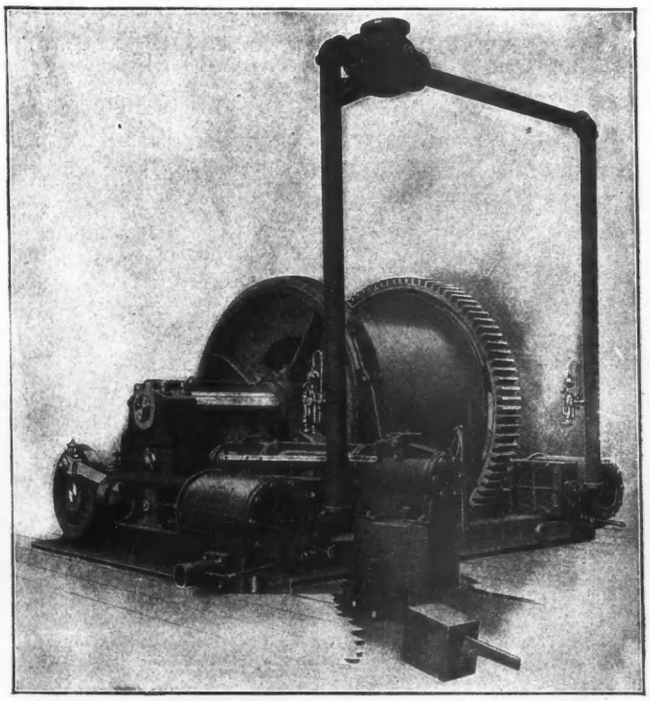
The Hendrie & Bolthoff Mfg. & Supply Co.,

Denver, Colo., U. S. A.

THE WELLMAN-SEAVER-MORGAN CO.

WELLMAN-SEAVER-MORGAN ENGINEERING DIVISION — ENGINEERS AND MANUFACTURERS — WEBSTER, CAMP & LANE DIVISION

Steam Hoists



Economy and Absolute Safety of operation
are the results obtained by using

Our Special Selfcontained Geared Automatic Hoists.

These Hoists are especially adapted for small coal mines and the illustration represents our No. 17 size which is designed to handle 300 to 400 tons per day of 8 hours at a depth of 200 to 300 feet.

Advantages:

Operating one lever at the tipple floor sets the Reversing Link, releases the Brake, and opens the Throttle, after which the Hoist requires no attention.

As the Cage reaches the tipple floor, the throttle is Automatically closed and the Brake set making it impossible to over wind, or to run the Cage into the Headsheave.

Fully described in Catalog H. O. 8 Mailed on request.

General Offices: Cleveland, Ohio, U. S. A.

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Mexico, D. F., Apartado 1220—14 a de Guerrero 3326.
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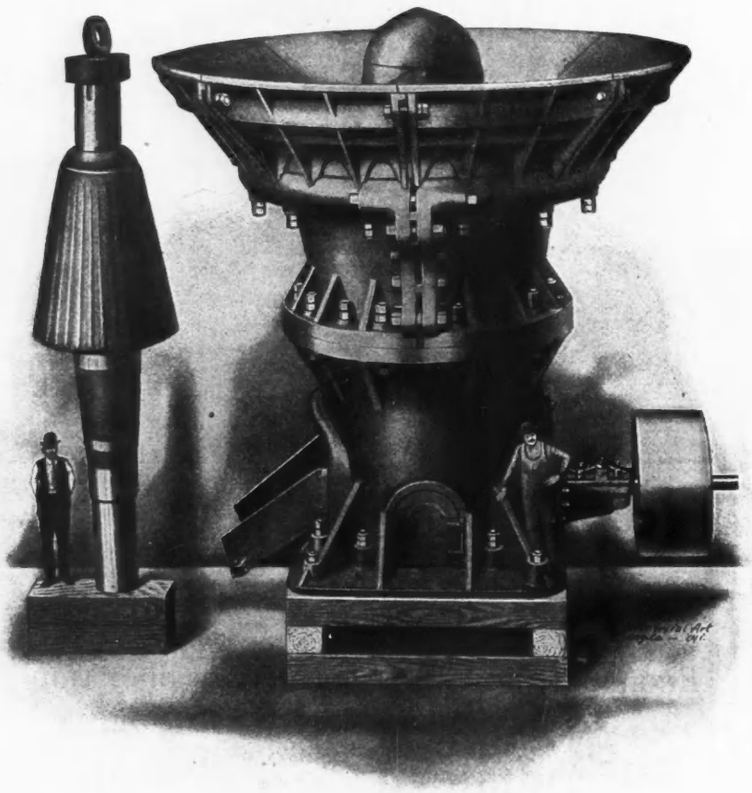
London House, Wellman-Seaver & Head Limited, 47 Victoria St., S. W.

POWER AND MINING MACHINERY COMPANY

Mammoth McCully Crusher



The McCully Crusher is the original of the gyratory type of crushers. It is preferred and used by the world's largest contractors as well as the U. S. government because it is preeminently efficient and economical.

Write for Catalog 4 J—"Machinery for Rock Crushing Plants."

SALES OFFICES
Chicago, Ill., First National Bank Building.
Mexico City.
San Francisco, 322 Sheldon Building.

Works and Office
Cudahy, Wis.
Suburb of Milwaukee

SALES OFFICES:
New York City, 115 Broadway.
El Paso, Texas, City National Bank Building.
Salt Lake City, Comc'l Club Bldg.

Subject, Concentrating Mills:
Denver, Colorado, Dec. 25, 1909.

Mr. Mine Manager:

Your mine is now sufficiently developed to warrant the milling of a considerable tonnage. You have found that profitable ultimate treatment of your ore requires concentration at the mine and you are now looking for competent and reliable people to whom you can safely entrust the design and equipment of the mill.

You have no doubt already figured out what a slight difference in percentage of recovery (say even 2½%) means in the profit from your operations and have been impressed by the result of your calculation.

Undoubtedly you also realize that upon your selection will depend the outcome of a very considerable investment, for your experience has shown you many a good mine converted into a disastrous venture by a poor mill.

We appreciate the gravity of your problem. Our engineers have devoted fifteen years of study to the theory of concentration and fifteen years of experience to the practice of it. They know the many little things essential to the smooth, continuous, and highly efficient operation of such a plant, and they are at your service.

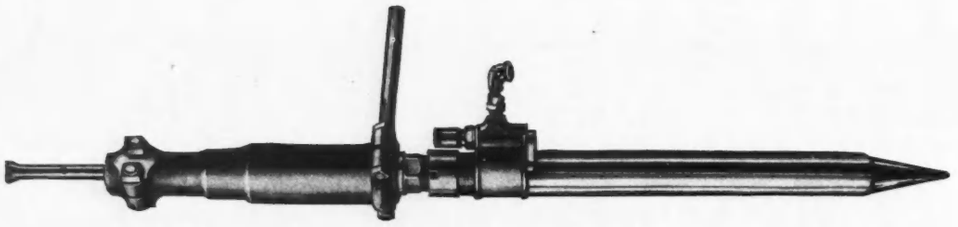
Two things deserve your consideration:—our especial competency in the design of concentrating mills, and the quality of our apparatus.

Come and see us.

THE DENVER ENGINEERING WORKS COMPANY

Denver, Colorado, U. S. A.

SALT LAKE CITY: District Office for - - - - - - - - - Utah, Eastern Nevada, Western Montana, Idaho.
EL PASO: District Office for - - - - - - - - - Eastern Arizona, New Mexico, Sonora and Chihuahua, Mexico.
SAN FRANCISCO: } Sales Agents: Harron, Rickard & McCone for California, Western Nevada, Western Arizona.
LOS ANGELES: }
MEXICO CITY: Sales Agents: Victor M. Braschi & Co. for Eastern, Central and Southern Mexico.



A Heart To Heart Talk

You've heard the story of the owner of a restaurant who was caught by one of his regular customers one noon in the act of hurrying out of his place.

"Where are you going?" asked the steady patron.

"Out to get lunch;" was the reply, "you don't suppose I eat here, do you?"

Which brings us down to our point that a great many manufacturing concerns are a good deal like this man. They don't use their own product. Some of them can't—the rest wouldn't if they could.

Now it stands to reason that *we* naturally cannot use Wonder Rock Drills in our manufacturing business. But you can bet your bottom dollar that if we *were* engaged in any line that required *rock drilling* we'd use **Wonder Rock Drills.** We happen to know, from inside information, that there isn't another rock drill made that can touch a Wonder. And the drill we'd use ourselves is the one we refer to you.

We'll be perfectly frank with you. And if we make claims that sound too big it's up to you to *prove* that we are wrong before you say, "I don't believe it."

Consider your present tonnage. **Wonder Rock Drills will increase it.**

Figure up your present costs. **Wonder Rock Drills will reduce them.**

One Throttle To Regulate

Consider how long your present equipment lasts. **Wonder Rock Drills will last longer.**

Count the number of parts your present drills have. **Wonder Rock Drills have fewer.**

Figure the number of feet of holes you are drilling at present per cubic foot of air consumed. **Wonder Rock Drills will drill more.**

Think how the operator, with your present drills, attaches the hose to the drill and then has to swing the hose with the drill. **Wonder Rock Drills permit the hose to be attached to the air feed cylinder and save the unnecessary labor of operator swinging the hose.** They have a Double Air Feed Cylinder. **Now** do you begin to see why a Wonder Rock Drill is **different**—and better?

Won't you give this drill a chance in your mine? You can do so without incurring the slightest risk. We stand back of every one of our drills with an offer to take back any drill that does not give entire satisfaction and live up to our claims. If, after having given the Wonder a fair trial, you are disappointed, send us back the drill.

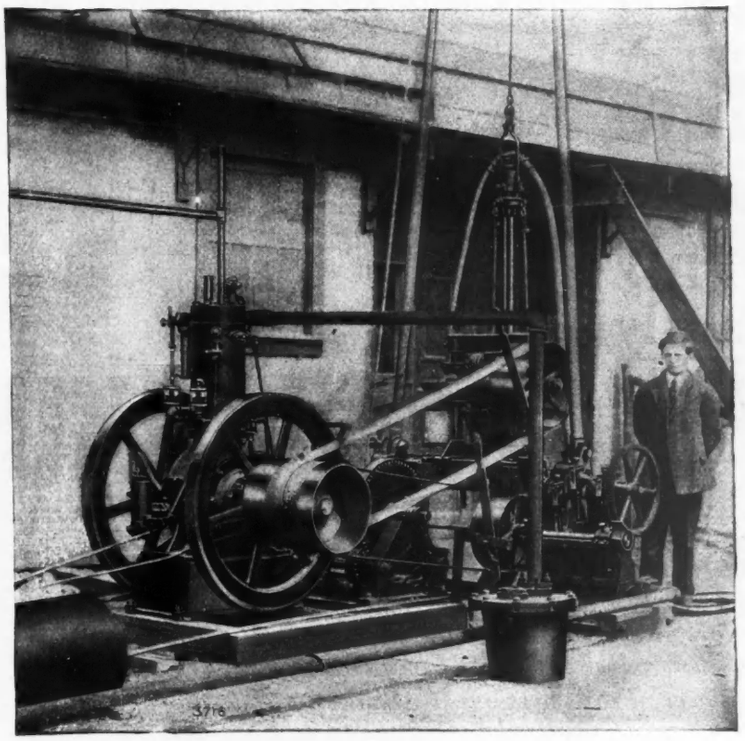
This is not to be taken as the usual **free** offer. It is a **guarantee** which goes with every drill we sell. Thousands of Wonders are in use. Shall we refer you to users?

By The Way—"Merry Christmas"

Hardsocg Wonder Drill Company,

Ottumwa, Iowa

The DAVIS CALYX DIAMONDLESS CORE DRILL



In mine prospecting success depends upon the economy, and in even greater degree upon the reliability of the core drill used.

The Calyx Drill, in any material, produces a larger and more perfect core than any other known method, and at a cost from 30 per cent. to 50 per cent. less. The total cost of a complete Calyx equipment is often less than that of the diamonds alone for a diamond drill of equal capacity.

ELECTRIC AIR DRILLS **HAMMER DRILLS**

ROCK DRILLS **COMPRESSORS** **AIR TOOLS**

INGERSOLL-RAND CO.

NEW YORK **LONDON**

Chicago, Boston, Denver, Mexico, Philadelphia, Birmingham, San Francisco, Valparaiso, Cleveland, Pittsburgh, Los Angeles, Lima, St. Louis, Houghton, Vancouver, Paris, Butte, Seattle, Montreal, El Paso, Salt Lake, Toronto, Berlin, Melbourne, Johannesburg

E-146

THE LARGEST MINING MACHINERY HOUSE IN THE WORLD

THE MINE & SMELTER SUPPLY CO.

SOLE OWNERS AND MANUFACTURERS OF THE WILFLEY CONCENTRATING AND SLIME TABLE

Anything For A Mine

We Can Supply Instantly Exactly What You Want

Every one of our houses in four different cities is ready to supply your mining wants. Each house carries a big stock—

Horse Whims, Pumps, Compressors, Steam Hoists, Ore Cars, Rails, Boilers, Ore and Water Buckets, Pipe, Machinists', Blacksmiths', Contractors' Supplies.

Power Transmission Machinery.—All Apparatus and Chemicals required by Chemists and Assayers.

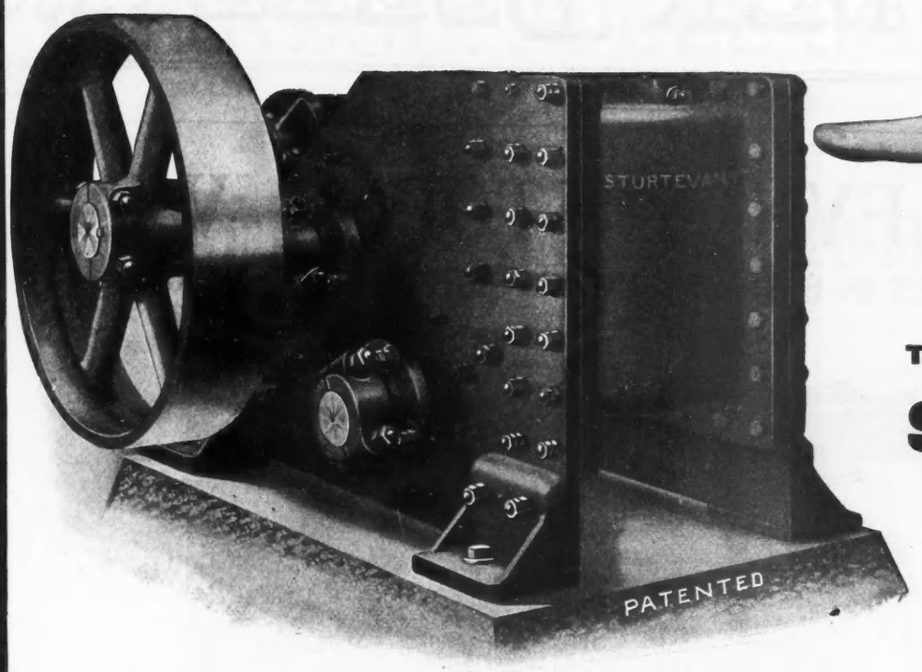
Zinc Shavings, Potassium Cyanide, Quicksilver and Heavy Chemicals.

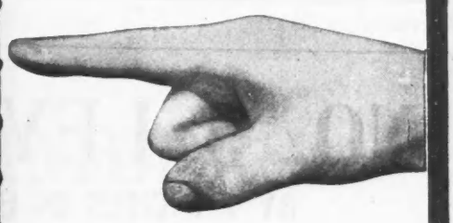
The accessibility of at least one of our houses to your mine means quick delivery—for we can ship the goods instantly.

We are the largest mining machinery and supply house in the world and can quote you the right price on anything.

Write to the nearest house.

42 Broadway, New York City ~ Denver ~
El Paso ~ Salt Lake City ~ City Of Mexico





THIS IS PLATE

STEEL

AND

UNBREAKABLY STRONG

PLATE STEEL vs. CAST IRON

RIGID	DEAD WEIGHT
PORTABLE	COSTLY WEIGHT
100% EFFICIENT	USELESS WEIGHT
NO WASTE	50% WASTE
NO JUNK	50% JUNK

DIFFERENCE IN COST FOR FREIGHT AND HAULING IN 50 TO 75%

Why buy Cast Iron Crushers when Plate Steel is cheaper and better in every way! Why not build a cast iron bridge, or building, or trestle, or steamboat, or gun, or anything else where great strength or reliability is valued? Why not? Because steel is better—stronger, more reliable—and Plate Steel is without brittleness, without flaws, and *lighter* (four times as strong for the same weight). Where is strength more needed than in Crushers? Buy Plate Steel Crushers and get the best for coarse, for intermediate and for fine reduction. They are good enough to *sell on trial.*

SEND FOR CATALOG NO. 62.

STURTEVANT MILL CO., BOSTON, MASS.

THE LEYNER BULLETIN

December 25 Littleton, Colo., U. S. A. 1909

NO. 5 LEYNER STOPER WINS

BY 7 INCHES IN EVERY 36 INCHES—31 PER CENT. MORE.

No. 5 Leyner Stoper.

Extract of letter 9/29/'09, from one of our representatives:

"—— came with a new machine with which he wanted to show how badly he could beat the Leyner, claiming that they bought our drills after a trial of a new Leyner against a worn-out ——. —— said it made no difference to him as he wanted our machines because they *stayed underground* and the —— did not. While I was out on my last trip he came back and they tried it again. Each machine drilled holes side by side in No. — stope, one of the hardest, and the Leyner beat —— 7 inches in each hole 36″ deep.

The above is simply another instance of what is occurring everywhere, in hard rock and soft, which versatility is possible mainly on account of the "balance" of the drill. Our No. 5 Stoper is a fast driller, easy to turn and "stays underground."

Send for Bulletin No. 1002.

MADE BY THE HAMMER DRILL PIONEERS

The J. Geo. Leyner Engineering Works Company,

General Offices and Works: LITTLETON, COLO., U. S. A.

BRANCHES OR AGENCIES IN PRINCIPAL MINING CENTERS.

Manufacturers of a complete line of HAMMER DRILLS, covering the entire field of rock drilling; Drill Sharpeners, Air Compressors, Oil and Coke Furnaces, Steam and Electric Hoists, Cars, Cages, Skips, Etc.

ASK FOR THE CATALOGUES

CARNEGIE STEEL COMPANY

GENERAL OFFICES, PITTSBURG, PA.

STEEL MINE TIMBERS

Mine timbering is most efficient and economical in steel. This 1500-foot gangway at the Williamstown Colliery, Summit Branch Mining Company, speaks for itself.

For information apply to

CARNEGIE STEEL COMPANY

Birmingham Buffalo Cincinnati Denver New Orleans Philadelphia Portland St. Louis
Boston Chicago Cleveland Detroit New York Pittsburg San Francisco St. Paul

Export Representatives: United States Steel Products Export Co., New York.

THE MOORE
SLIMES PROCESS

REPLY TO BUTTERS ADVERTISEMENT.

The advertising pages of a technical journal are not the place, in the opinion of *our* counsel, for discussing patent cases. Much less is it the place to disseminate misleading information concerning them, such as is contained in a recent advertisement of the Butters Patent Vacuum Filter Company, which is intended to convey the impression that we are not vigorously prosecuting the pending suit against the Butters Filter, and that we have already suffered defeat as to some aspects of it.

The exact contrary are the facts.

We closed our prima-facie proofs in this case about the middle of February last. The Butters Company did not close its reply proofs until about three weeks ago—an interval of nine months, lacking a few days. We shall proceed promptly with our rebuttal proofs and expect to have the case heard at the spring term of the court.

As to the alleged refusal of our adversary's counsel to consent to altering the issues, the fact is he was not asked to consent to anything. What he did, as a matter of fact, was to make a motion last winter to dismiss our complaint as to one of our patents, on which we did not elect in this suit to rely, and *the Court denied his motion.*

We have reluctantly entered here into a discussion of court proceedings because we feel it to be our duty to correct, by a plain statement of facts, the false impressions intended to be conveyed by the Butters advertisement.

The Moore Filter Comp'y

This Company either EXCLUSIVELY OWNS or EXCLUSIVELY CONTROLS the Moore-Cassel-Clancy patents and pending applications

Cable: Morefilter. **New York, U. S. A.** *Cable: Morefilter.*

Butters Filters vs. Moore Slime

We feel compelled to inform our friends and those interested, of the following facts (*which are not matters of opinion.*)

March 16, 1908, Moore Filter Company sued **Tonopah Belmont Development Co.** on Moore process patent and Moore apparatus patent.

May 27, 1908, case was at issue for taking of proofs "three months and not longer." (Supreme Court rule for practice in equity.)

We have vigorously defended the **Tonopah Belmont Development Company,** relieving them of the entire care of the litigation, and our counsel, **Harold Binney,** informs us that the testimony has not yet been closed, that our defenses have been completed and that as yet the Moore people have taken no reply testimony.

October 10, 1908, Moore Company abandoned the charge of infringing the Moore apparatus patent by the Butters patent filter, and our counsel refused "consent to this method of altering the issues."

The claim of the Moore Company that **6,000,000 tons annually** are treated under Moore's patents is reconciled with the truth that the Butters patent filter treats **nearly all of this,** by the interesting fact that the Moore Company **includes all the Butters Filters** and several others in this estimate.

Postscript: We are glad to have the **Moore Company confirm the above statements** by their advertisement of Dec. 11th, facing ours, in which they show that from the middle of February last until about three weeks ago, **"An interval of nine months lacking a few days," they allowed the defendant to leisurely proceed with its defences.**

The words in which **their counsel conceded that the Moore Apparatus Patent was useless** against the **Butters** Patent Filter were the following:

"I do not intend to rely in this case on the Apparatus Patent."

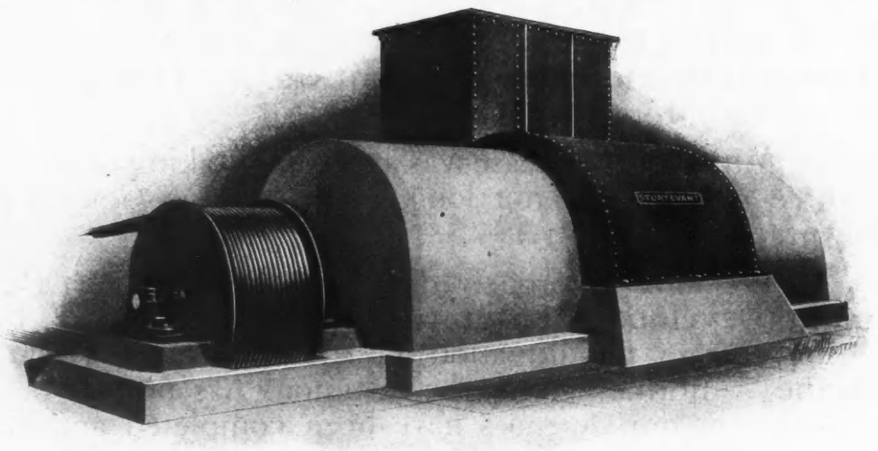
The Butters Patent Vacuum Filter Co., Inc.,

333 Kearny Street, San Francisco, Cal.
30 Church Street, New York } **Cable: Butters**
Gante 1, Mexico, D. F.

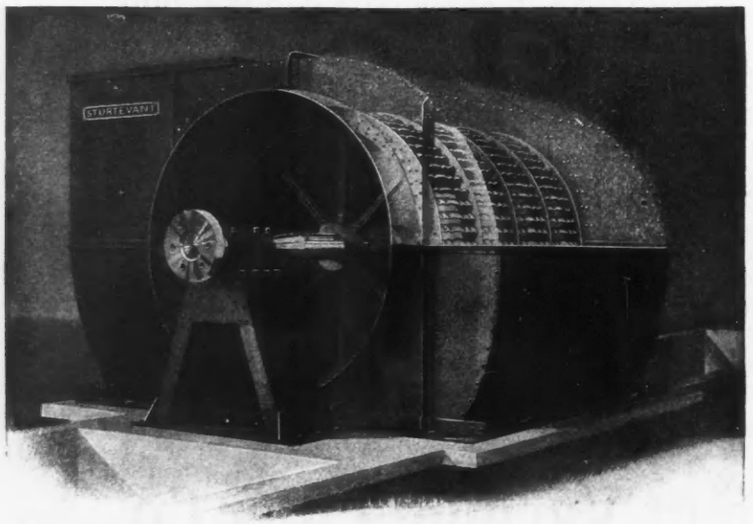
54 New Broad Street, London, E. C. **Cable: Armisonus.**

AGENTS—Fraser & Chalmers, London and Branch Offices, Paris, Johannesburg, Bulawayo, Sekondi, Singapore, Montreal, Valparaiso and elsewhere.
Fried. Krupp, A. G., Grusonwerk: Magdeburg, Germany and Representatives in London, Montreal, Salisbury, Rhodesia and elsewhere.
The Sandycroft Foundry Co., London and Chester, England.

STURTEVANT MINE FANS



The Sturtevant Mine Fan is a thoroughly up-to-date design for handling large volumes of air against the resistances met in this service. The wheel is of the multivane type, which permits very large inlets, a feature that contributes to high efficiency because the friction loss of the entering air is a minimum. The blades or floats are spooned to distribute equally the pressure of air within the fan and to add strength and rigidity to the blades. The housing is of steel plate rigidly braced by steel angles and fastened to foundations of brick or concrete, of which material the inlet housings also are made. To insure freedom from shut-downs, the shaft is made extra heavy and special attention has been given the bearings. Vibration is eliminated by use of the best devices for balance.



STURTEVANT MINE FAN 250,000 Cu. Ft. Per Minute.

We do not advertise high manometric efficiency, but for every condition will furnish the MOST EFFICIENT and MOST SATISFACTORY fan in the WORLD.

B. F. STURTEVANT CO., Boston, Mass.

General Office and Works, Hyde Park, Mass.

NEW YORK PHILADELPHIA CHICAGO CINCINNATI LONDON

Designers and Builders of Heating, Ventilating, Drying and Mechanical Draft Apparatus: Fan Blowers and Exhausters, Rotary Blowers and Exhausters: Steam Engines, Electric Motors and Steam Turbines: Pneumatic Separators, Fuel Economizers, Forges, Exhaust Heads, Steam Traps, etc.

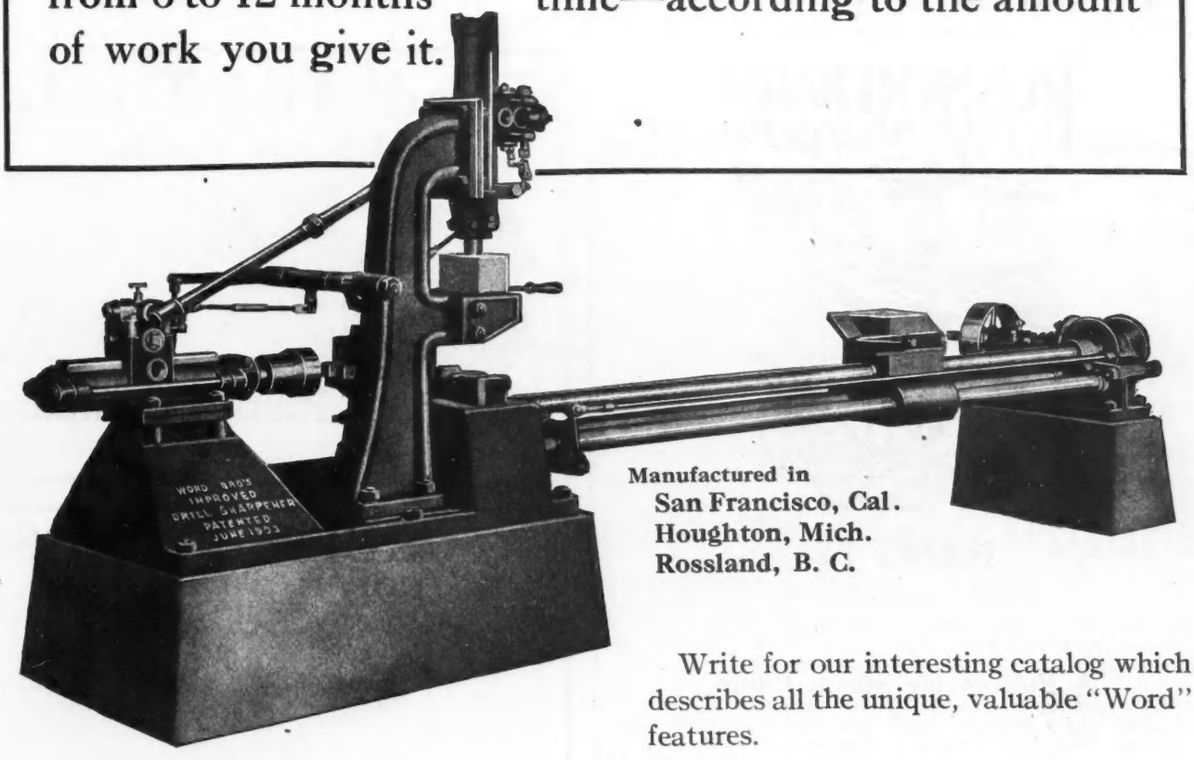
714

THE Word Drill Sharpener sharpens 600 to 800 old drills a day or makes 500 to 700 new ones from blank steel.

This machine has double the life of any other because the dies and dollies last more than twice as long as any others—and they cost only 1/4 as much to renew.

Everything is made easy for the operator and the "Word" is the only machine which has automatic controlling valves which permit the operator to handle both hammers by a single foot treadle.

The Word Drill Sharpener will save its cost in from 6 to 12 months' time—according to the amount of work you give it.



Manufactured in
San Francisco, Cal.
Houghton, Mich.
Rossland, B. C.

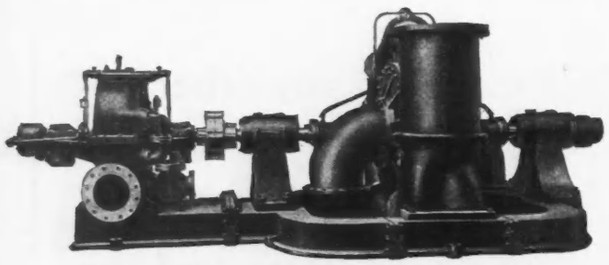
Write for our interesting catalog which describes all the unique, valuable "Word" features.

Word Bros., 60 Castro St., San Francisco, Cal.
29 Broadway, New York.

Pumping Water With Least Steam Consumption

The illustration herewith shows a 180-hp. Terry steam turbine direct-connected to a centrifugal pump, capacity 20,000 gals. per minute, against a 25-ft. head. The previous articles published in this paper show pumps for much higher heads. Any capacity and head, from the smallest to those requiring several hundred horsepower, can be handled with the greatest economy and advantage by these turbo-pump units.

Unsolicited letters from users are a pretty fair criterion. One of our customers recently wrote to a friend, "We have two 35-hp. Terry turbines, driving hot well pumps; as for the turbine ends we have never had occasion to make any repairs on them during nearly three years they have been in operation. We also have a 50-hp. Terry turbine belted to a forced draft fan. This is situated in an ash cellar, where we were unable to keep an engine running at all (on account of the dirt), and the turbine has been in about three months, and is apparently as good today as when installed. We have entirely dropped the use of small engine-driven units, and are installing turbines on them in our generating stations. The first cost is cheaper, and I figure that the maintenance cost for the first five years is practically nothing, and the attendance is practically cut out. We would be pleased to show you our turbines by appointment any time when it is convenient to you."



A 130 H.P. Terry Steam Turbine, Direct-Connected to a Centrifugal Pump.

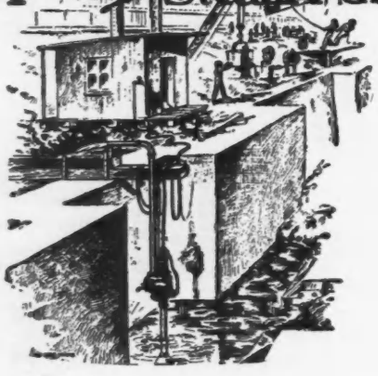
There is a larger opportunity for saving money by improving methods of mine pumping than in any other similar line. This work is usually handled by direct acting pumps. They are admittedly not economical in steam consumption. Take as an example, a pump to handle 2,000 gals. per minute against 200-ft. head. A direct acting pump of such capacity, and of any of the best makes, will cost about $2,100 f.o.b. Chicago; weight 22,000 lb. The average steam consumption for a year will not be less than 120 lb. per indicated horsepower per hour. A turbine driven pump will cost about $2,600; weight 8,000 lb. The average steam consumption (non-condensing) for a year will not exceed 40 lb. per indicated horsepower per hour. Estimating coal at $2 per ton, and an evaporation of 5 lb. of water per pound of coal, the saving effected by using the better machinery will amount to $3,200 each year it is in operation. *It seems useless to say more.* Steam consumption and capacities of turbines are absolutely guaranteed.

The superheating of steam increases the efficiency of a turbine very materially. It is safe to figure that for every 10 deg. superheat the steam consumption per horsepower will be reduced 1%.

Turbines can be operated very advantageously with compressed air instead of steam. This requires somewhat special construction, but the results obtained will be remarkably satisfactory, especially so if proper facilities for heating the air are provided.

Terry Steam Turbine Co., 1775 Old Colony Bldg., Chicago.

Pulsometer Steam Pump



HANG IT

You can hang a Pulsometer and it will drain a flooded gallery, level, mine shaft, or raise tailings even if it must work under water.

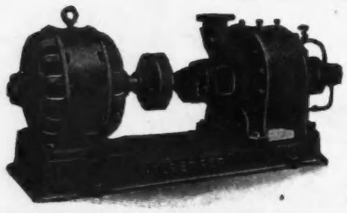
A Pulsometer Steam Pump

has no easily deranged inside or outside mechanism to become choked or clogged. Requires no oiling, packing, or special foundation——a steam pipe from the boiler only.

Illustrated, Descriptive Catalog Gratis

PULSOMETER STEAM PUMP CO.
15 BATTERY PLACE, NEW YORK
Chicago Office: 223-231 No. Jefferson Street

Tried And Trusted
Alberger Pumps

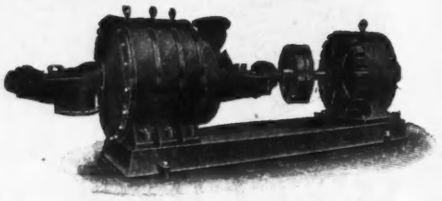


Alberger Pumps are always reliable and are built to stand up to the hardest service for the longest time. They are best for severe mine duty. Let us tell you all about our Turbine Pumps.

Alberger Pump Company,
205 La Salle Street, Chicago, Ill. 95 Liberty Street New York 1417-1418 Chemical Bldg. St. Louis, Mo.

TURBINE PUMPS
FOR HIGH LIFTS

Fitted with Automatic Balancing Device—No Thrust or Roller Bearings Used—All Sizes.

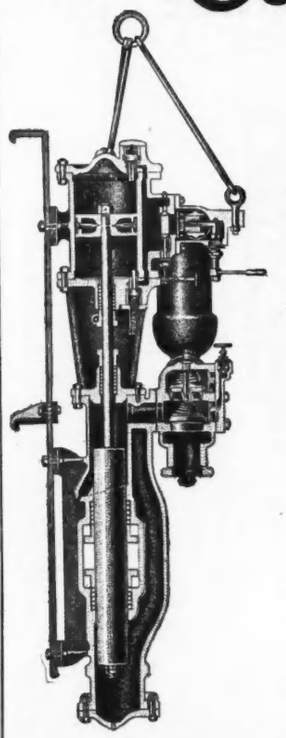


BULLETIN M-22

KROGH PUMP MANUFACTURING CO.
133 Beale St., San Francisco.
Denver Agents: Burnite Machinery Company.

The Slogan of the Cameron—"Character: The Grandest Thing."

Cameron Pumps



Of The Vertical Plunger Sinker Type

solve the numerous pumping problems of unwatering mines, being superior to any other make of pump on the market and are almost exclusively for such work. Often a Cameron pump has been buried for weeks under water and a mass of debris and has kept right on pumping to the limit of its capacity. Just put it where it can reach the water—no matter how gritty—and a *Cameron will do the rest.*

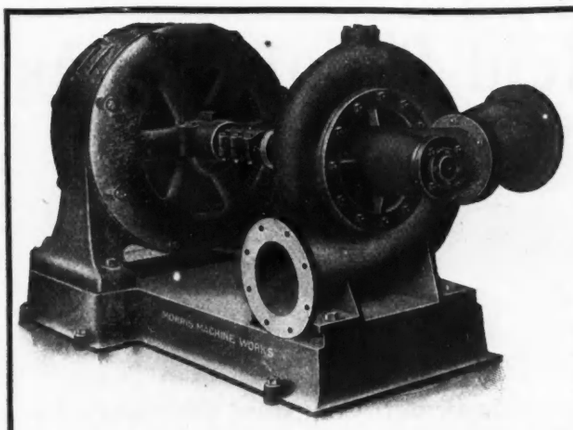
Look At This Sectional View

We reason that the more movable parts there are in a pump the more energy it takes to operate it. The greater the unit of friction, the more liability of breakage, the more wear, the more tear, the more the repair bills.

But let us send our catalogue, Edition "G." In it we enter into details of construction and show the different types and sizes of pumps we build, besides giving lots of other information to engineers.

A. S. Cameron Steam Pump Works,
Foot of East 23rd Street, New York

Dec. 25.



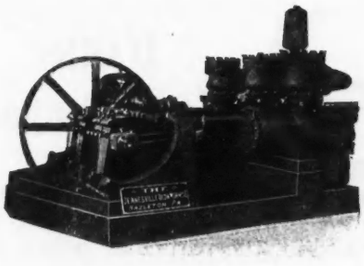
Morris Centrifugal Pumps

Require Minimum Repairs

For mining or other services where repairs are unduly expensive and delays must be eliminated there is no pump on the market that is better than a Morris Centrifugal. *Write.*

Morris Machine Works, Baldwinsville, N. Y., U. S. A.
Charlotte, N. C. New York, 39-41 Cortlandt Street.

Henion & Hubbell, Agents, 223-231 N. Jefferson St., Chicago, Ill., Harron, Rickard & McCone, Agents, San Francisco and Los Angeles. Cameron & Barkley Co., Agents, Charleston, S. C., and Tampa, Fla. Harris Pump and Supply Co., Pittsburg, Pa.



Write For Information Today

Jeanesville Electric Pumps

For Mining Service Are In A Distinct Class By Themselves — Because

All parts are accessible.
Shafts have bearings between each two cranks.
All bearings are adjustable.
The highest efficiencies are guaranteed.
Our heavy construction is used throughout.
The construction is simple—no experts required to keep machine in order.

Jeanesville Iron Works Co., Hazleton, Penna., U. S. A.

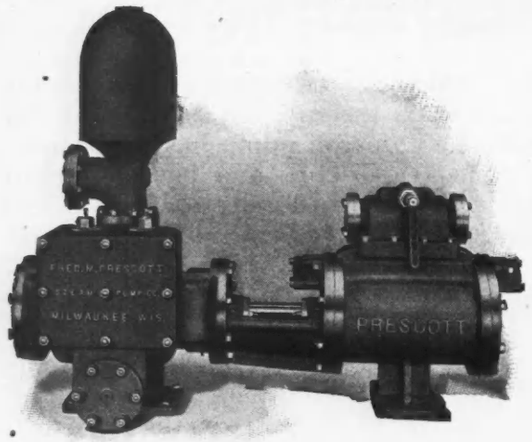
Jeanesville Iron Works Co.,
Hazleton, Penna.
Send me Bulletin E. M. J. 30

Name .....

Address .....

MINE PUMP

For Shaft and Emergency Work



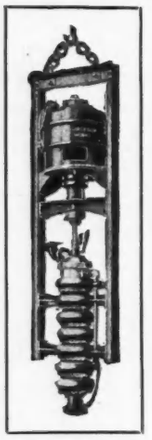
Carried in Stock

¶ A short, strong, compact pump, with *immediate* access to *all* water valves by removal of *one* side plate. Send for our Mine Pump Catalog 20-B.

Fred. M. Prescott Steam Pump Co.
Milwaukee, Wisconsin
District Sales Offices—El Paso, Texas—Atlanta, Ga.—Salt Lake City, Utah. 60

The Jackson Patent Suspended Mine Pump

A remarkably efficient pump, unsurpassed for reclaiming flooded mines, giving great quantities of water under low lifts and gradually decreasing quantities as the water recedes.



No valves to wear or get out of order. No dug pits are required. No noise of gears or breaking of teeth. Always ready to operate.

Belt Drive Or Direct Connecting

This and every other Jackson Pump is worthy your consideration. Write us for complete catalogs and detailed information.

Byron Jackson Iron Works,
San Francisco, California.

DEMING TRIPLEX MINE PUMPS

Adapted for Any Power

Fig. 61.

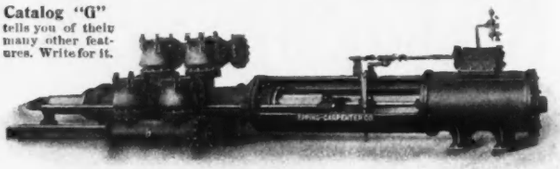
Built in Four Types and Any Sizes

Hendrie & Bolthoff M. & S.Co.,Denver. Heushaw, Bulkley & Co., San Francisco. Harris Pump & Supply Co., Pittsburg. Henion & Hubbell, Chicago. W. P. Dallett, Philadelphia. Chas. J. Jager Co., Boston. Ralph B. Carter Co., New York. L. Booth & Sons, Los Angeles. English Iron Works Co., Kansas City.

The **DEMING COMPANY, Salem, Ohio.**

Acid Proof Pumps

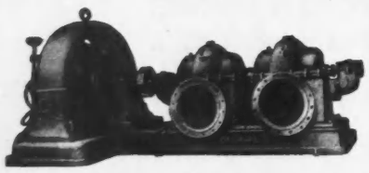
Catalog "G" tells you of their many other features. Write for it.



These pumps are splendidly adapted for use in waters that are impure, and withstand the ravages of time and acid. We make them simple, compound or triple.

Epping-Carpenter Company, Pittsburg, Pa.

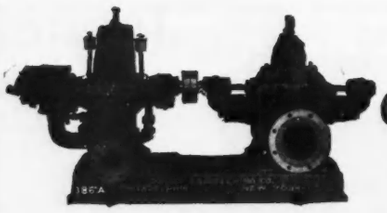
DE LAVAL



This type of pump is used in Filtration plants, for Irrigation, Drainage and in Sewage Disposal Works, where large volumes are to be handled against low heads with high efficiency and where standard motor speeds are desired.

SEND FOR CATALOG No. 49.

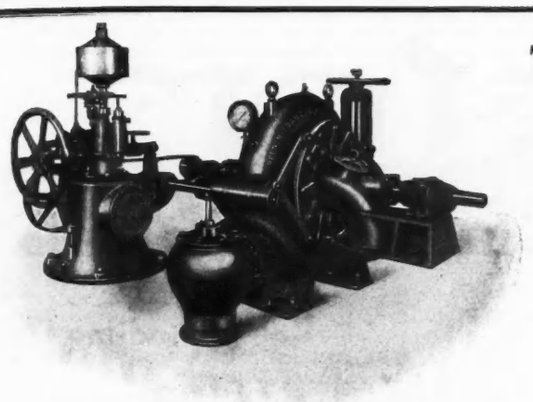
DE LAVAL STEAM TURBINE CO., TRENTON, N.J



D'Olier Centrifugal Pumps

Each pump designed for the particular service it is to perform.

D'OLIER ENGINEERING COMPANY
PHILADELPHIA, 121 S. 11th Street
New York, 116 Liberty Street



TURBINE WATER WHEELS

For Moderate and Low Heads
Furnished and Installed.

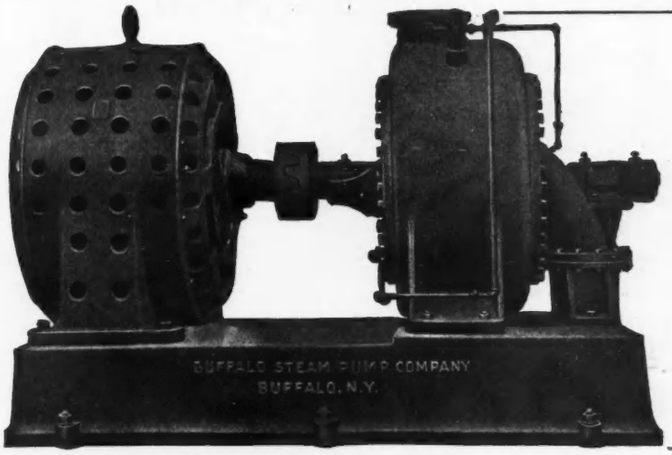
Efficiency, Design, and Regulation Beyond Criticism.

Write for Catalog and List of Operating Plants.

The Pelton Water Wheel Co.

1010 Monadnock Bldg. **San Francisco, Cal.**
87 West St. **New York City.**

Illustrated Bulletin of the 20000 H.P. Pelton Turbine Installation of the Schenectady Power Co. Mailed Free.



Buffalo Mine Pumps

Any Type, Any Head, Any Capacity

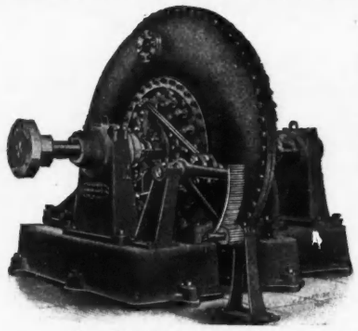
Illustration shows a 14″ 2 Stage Motor Driven Pump for mine use near the Straits of Magellan. Order secured on high efficiency guarantee which was exceeded in final test.

May we figure on your proposition and send you Catalogue?

Buffalo Steam Pump Co.

Buffalo, N. Y.

FRANCIS and McCORMICK TURBINES



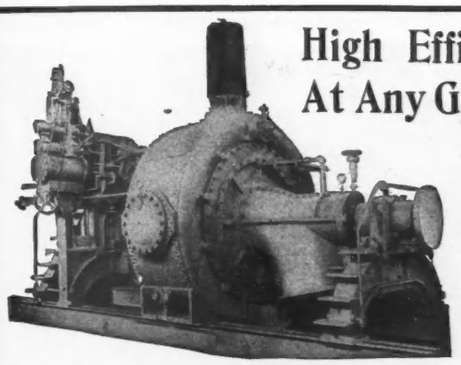
Francis Horizontal Shaft Turbines of 43,000 Horsepower are now being built, to operate Six (6) generators for the Great Falls Townsite & Water Power Company, Great Falls, Mont.

Water power plants for **High** and **Low** heads designed and estimates supplied by

S. MORGAN SMITH CO., York, Pa.

644 American Trust Bldg., Chicago — 176 Federal Street, Boston, Mass.

High Efficiency At Any Gateage



Samson Turbines are sectionalized and can be transported anywhere. All sizes.

Write for complete information.

James Leffel & Company,

306 Lagonda Street, **Springfield, Ohio, U. S. A.**

Frenier's Spiral Pump

The most durable pump for elevating
TAILINGS, SLIMES, BATTERY SANDS, ETC.
NO VALVES NO BUCKETS

FRENIER & SON, Rutland, Vt.

AGENTS—Allis-Chalmers Co., Chicago, Ill. Stearns-Roger Mfg. Co., Denver, Col. Harron, Rickard & McCone, San Francisco, California.

R. D. WOOD & CO., **400 CHESTNUT ST., PHILADELPHIA, PA.**

CENTRIFUGAL PUMPS

For Mines and Sinking Purposes

GRAVEL AND WATER PUMP

For Placer Mining a Specialty

CIRCULATING PUMP

Cast Iron Pipe, Tanks, Gas Producers and Iron Casting

THE BEST RESULTS
from your water power development can only be obtained by using

New American Turbines

BUILT BY

The Dayton Globe Iron Works Co., Dayton, Ohio.

Catalog No. 19 will tell you more

HOISTING ENGINES, FANS, MINE PUMPS.

ESTABLISHED 40 YEARS.

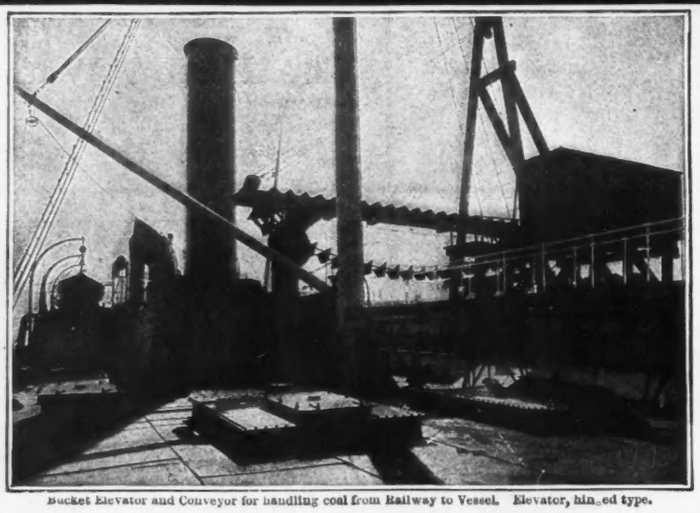
CRAWFORD & McCRIMMON COMPANY,
BRAZIL, IND., U. S. A.

Webster

ELEVATING and CONVEYING MACHINERY

For use in Mines Coaling Plant Cemens Mills

We Design, Manufacture and Install.



Bucket Elevator and Conveyor for handling coal from Railway to Vessel. Elevator, hinged type.

For handling Ores Coal Rock Sand and Gravel

WEBSTER M'F'G CO., Main Office and Works: 2410-2432 W. 15th St., CHICAGO.

BRANCH OFFICES:—New York, 88-90 Reade St. Philadelphia, Pennsylvania Bldg. Denver, 1720 California St., C. E. Dean, Mgr. San Francisco, Suite 522, Sheldon Bldg. Salt Lake City, Newhouse Bldg., Utah Eng. & Mach'y Co.

Quarter-turn rope drive and outfit of shafting equipment with split friction clutches.

THE DODGE LINE

includes everything for the mechanical transmission of power. Complete shafting outfits, Belt Drives, Rope Drives, Friction Clutches. Also elevating and conveying machinery.

The Dodge line reflects twenty-five years of studying to produce transmission machinery that will operate with the best possible efficiency and economy, the least waste of power.

We will be glad to advise with you in regard to your transmission requirements.

If you haven't our Catalog W-7 write for a copy.

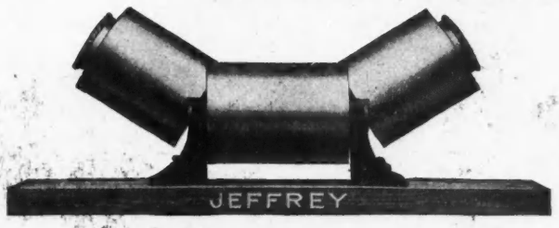
DODGE MANUFACTURING CO.

Sta. L-17. MISHAWAKA, INDIANA.

THE NEW

JEFFREY "CENTURY" RUBBER BELT

CONVEYER



costs less to install and less to maintain than any other.

THE BELT CARRIERS

are exceedingly strong, light in weight, perfectly self oiled and permit a minimum over-all width of conveyer.

The offset pulleys prevent the belt from cutting.

"CENTURY" RUBBER BELTING

is made to our order and is the highest quality of canvas and rubber obtainable.

These conveyers cannot be duplicated when prices and mechanical construction are considered.

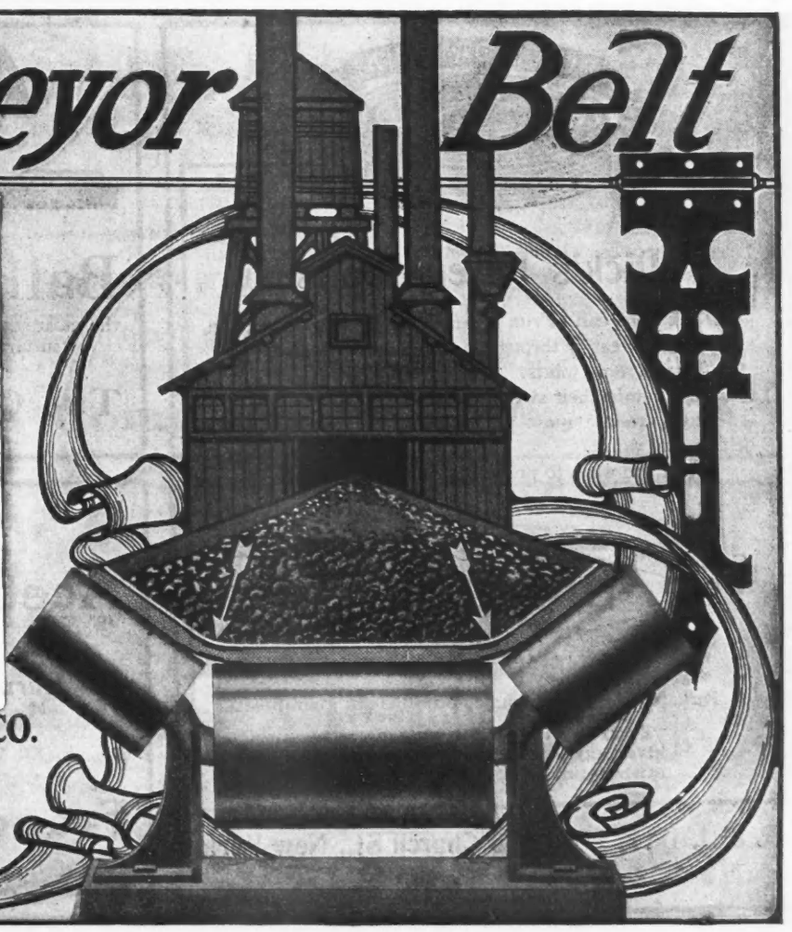
Let us figure with you.

THE JEFFREY MANUFACTURING COMPANY

COLUMBUS, OHIO

New York Chicago St. Louis Pittsburg Denver Boston Knoxville Montreal, Can.

Hinge Edge Conveyor Belt



HAS A NATURAL AFFINITY FOR THE PULLEY

It is rigid where it ought to be and flexible where it has to be. Takes a full face contact, eliminating slip and scour. Note where several plies of duck are replaced with tough flexible rubber.

The Most Successful Belt Ever Constructed for Troughing Conveyors.

Write for Illustrated Catalog.

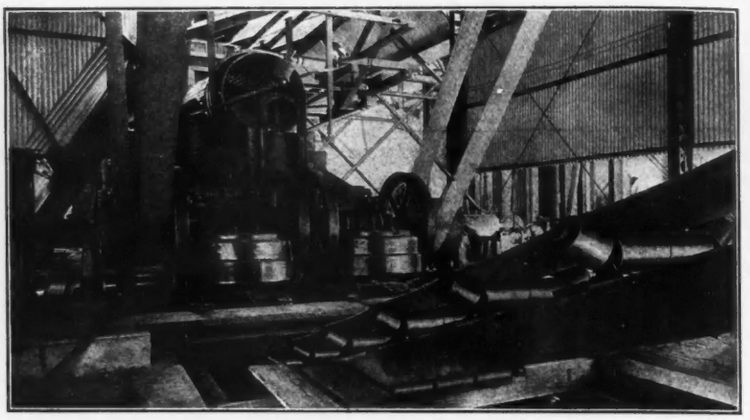
REVERE RUBBER CO.

BOSTON, MASS.

BRANCHES

NEW YORK PHILADELPHIA PITTSBURG
CHICAGO MINNEAPOLIS NEW ORLEANS
SAN FRANCISCO PORTLAND, ORE.

¶ Where Economy Is Most Necessary—There You'll Find The Robins Conveying System



¶ Where economy in handling has been *studied* and *investigated thoroughly*, there you'll find the Robins Conveying System. For no other system conveys material at so low a cost. The Robins System is the simplest; it consists of but two component parts, a belt and a fixed set of rollers or idlers. Are you interested in the simplest and most economical conveying of materials? If so, *investigate.* **Write us today.**

Robins Conveying Belt Company,

Thomas Robins, President — **C. Kemble Baldwin, Chief Engineer**

New York
Chicago

Passaic, N. J.
Established 1896.

San Francisco
New Orleans

Dick's Patent Belts

Dick Belts can be run in any atmosphere. They run smoothly and easily through steam and even water.

They have no joints.

They retain their strength.

They are the most powerful driving and conveying belts in the world.

Which we want to prove to you. So write us.

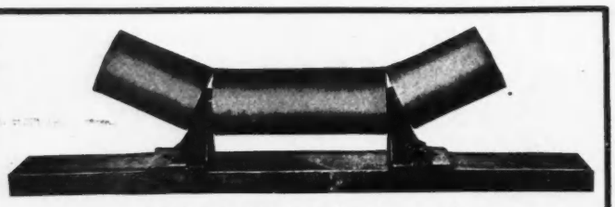
THE "DICKBELT"

Perhaps the best recommendation is our guarantee:

"Every belt sent out is guaranteed to give complete satisfaction, otherwise it can be returned to the manufacturers."

R. & J. Dick, L't'd., 50 Church St., New York

Agencies In All Principal Cities.



We Are Sole Manufacturers of

Ball Bearing Idlers

the most economical for conveying all materials. They save in power and require no lubrication. Make it your business to write for details.

The Conveying Weigher Co.
90 West Street, New York.

The "Scranton" Acetylene Mine Lamp

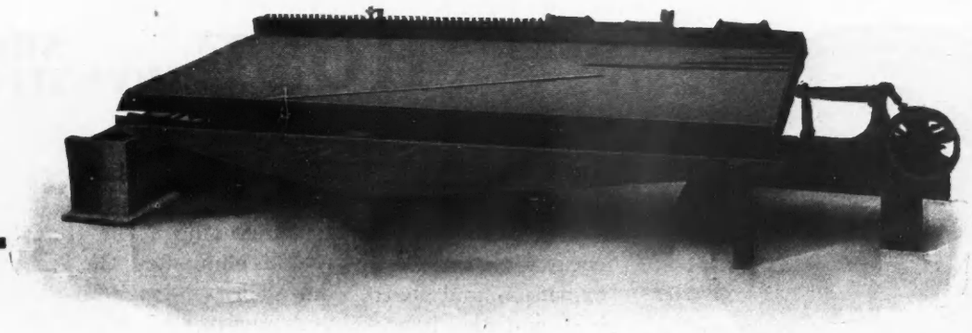
(Pat. applied for)

Burns Longer Brighter Flame
Simple—Durable

Write for particulars

Francis H. Coffin & Co.
General Sales Agents

Board of Trade **Scranton, Pa.**



This Is The New Concentrating Table

The thing that's new always claims your interest, but novelty alone never held it long. If an article holds your attention, it must be able to *prove merit.*

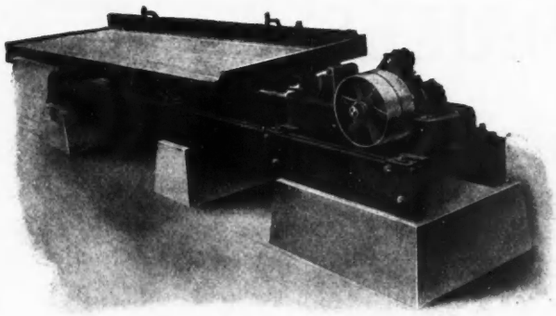
We want to prove to you the merit and the value of the new Dunham Table. We want to prove to you its large capacity, its *close-saving features*, its ability to withstand hard and heavy usage.

The Dunham Table

We have sold a number of these tables recently, but we have not sold one *without proving its superiority. first.* That's what we want to prove to you. Send us a sample of your ore, tell us the particulars and we'll give you exact information regarding what the Dunham Table can do *in your particular case.*

Your request will bring the details.

The Braeckel Concentrator Co., Joplin, Mo., U. S. A.



The Ford Concentrator

A few of the special advantages of the Ford come from a well-nigh perfect solution of the problem of longitudinal travel, secured by perfect head motion, perfect transverse motion of ore particles determined by the slope of the riffle, the best possible delivery in securing one or more concentrates, and simplicity of mechanical design in all working parts.

The Ford secures greatest results with least expenditure of power.

Write for catalog and get all the facts.

United Iron Works Company, Joplin, Mo., U. S. A.

Used In A Thousand Mines

This smokeless, brilliant, sparkless lamp has proved its worth in more than a thousand mines

Baldwin Acetylene Pit Lamp Costs 2c. For A 10-Hour Shift

It gives a steady, intense flame of from 10 to 14 c.p. at a cost of only 2 cents for a 10-hour shift—costs less to burn than the cheapest oil. It burns in light or poor air. *Let us send you details.*

John Simmons Co., 102 Centre St., New York.

View of Armor Construction of Sprague Flexible Steel Armored Hose

USERS OF HOSE SHOULD INVESTIGATE

THE SPRAGUE FLEXIBLE STEEL ARMORED HOSE

which lasts longer than any other kind. The armor entirely encases the rubber hose and eliminates the strain due to expansion and contraction. This prolongs the life of the hose and also increases its strength. It protects the rubber from injury and prevents kinking and chafing. This armored hose should not be confused with wire wound hose.

HAS UNUSUAL STRENGTH AND DURABILITY
BREAKDOWN AND DELAY ELIMINATED

If you want a durable hose get

SPRAGUE FLEXIBLE STEEL ARMORED HOSE

which is ideal for service in connection with the excavation of rock and in shops for pneumatic work.

A copy of descriptive bulletin No. 50732 will be sent free upon request.

SPRAGUE ELECTRIC COMPANY

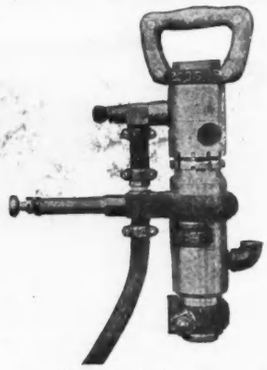
GENERAL OFFICES: 527-531 WEST 34th STREET, CITY OF NEW YORK

BRANCH OFFICES:
Chicago St. Louis Milwaukee Boston Baltimore Philadelphia Pittsburg Atlanta New Orleans San Francisco Seattle

MURPHY ROCK DRILLS

Write for bulletins describing different models

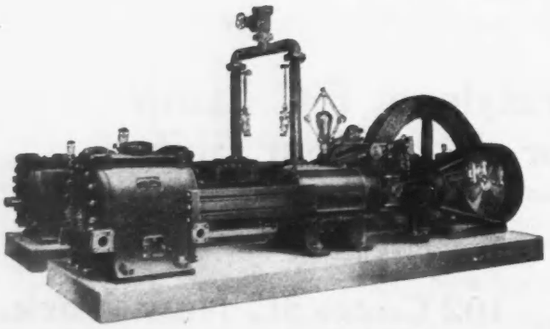
C. T. Carnahan Mfg. Co.
Denver, Colo., U. S. A.



Model F Sinker

McKIERNAN DRILL COMPANY,

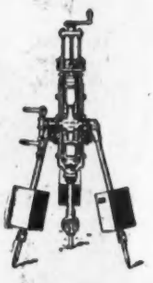
115 Broadway, New York City.



Complete Line of

AIR COMPRESSORS ROCK DRILLS

and Appurtenances



"Hands Up" Says The Wood

The Wood Drill makes the Earth deliver the goods in the shortest possible time.

Do you know why the Wood Drill is used by the U. S. Government and the biggest mining plants?

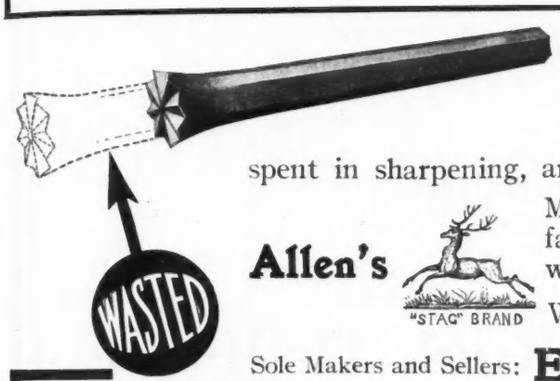
Because it's the lightest and most durable; because it requires fewest repairs; because the head is especially strong; because it has the least number of parts. Adaptable for all conditions; may be used with either steam or air.

We don't want to seem to be claiming the "earth" but—*we can show you.*

Write for Catalog E.

Wood Drill Works

34 Dale Avenue Paterson, N. J., U.S.A.



If you are still using ordinary drill steel you are wasting more than the amount of steel worn and sharpened away. You are wasting ⅔ of the time spent in sharpening, and are using dull drills 9/10 of the time.

Allen's

Mining Drill Steel requires less sharpening and cuts faster than any ordinary kind of steel. It is invaluable where extreme hardness and toughness is required.

Write us for full details, sizes, prices, etc.

Sole Makers and Sellers: **Edgar Allen & Co., Limited**

New York: 282 Pearl St.
Imperial Steel Works, Sheffield, England.
330 St. James St., Montreal, Canada.

434 W. Randolph Street, Chicago, Ill.

Trade SB Mark

For Well Bits **For Mining Drills**

Unquestionably The Best Steel

You'll say so after you have once tried it. Send for a *trial bar* at once, if it doesn't come up to your expectation the experiment costs you nothing. *Further particulars on request.*

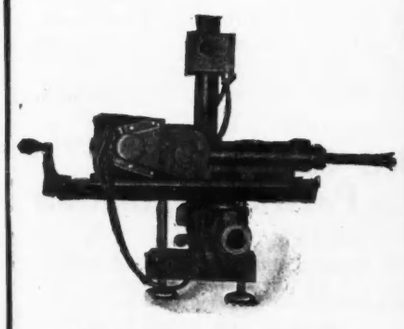
Braeburn Steel Co., Braeburn, Pa., U.S.A.

Diamond Drills

We make the most complete line in the world. Hand Power, Horse Power, Gasolene, Steam, Air, Electricity, Hydraulic Feed, Screw Feed.

Send for Catalogue.

STANDARD DIAMOND DRILL CO.,
Chamber of Commerce, Chicago, U. S. A.



The Dietz Airolectric Rock Drill.

THE DEITZ AIROLECTRIC ROCK DRILL

Does the work of an air drill of the same size.

Installation one-third the cost of the old style rock drill plant.

Will break as much rock for **half** the money.

Will operate with one-tenth the power.

These claims are made under **Absolute Guarantee.**

The Economic Machinery Company
202 Exchange Building
Denver, Colo., U. S. A,
CATALOGUE A.

A Wrench Repairs It At The Mine

A small, simple wrench is the only tool needed to repair the **Cleveland Stope Drill.** It is the drill with the fewest parts—the greatest cutting capacity—the lowest cost of maintenance and the longest life.

To prove that the "Cleveland" is the most wonderful and efficient drill in the world for stoping we'll send you an equipment on 30 days' trial. Place it in the hands of a green operator and see how easily he "*catches on to it.*" Test the "Cleveland" alongside of other machines and decide whether you want to keep it or not by what it does.

Write at once for Bulletin No. 40-A.

The Cleveland Rock Drill Co.,
Cleveland, Ohio, U. S. A.

IF YOU WANT STRONG AND TOUGH DRILL STEEL REMEMBER THAT THE

BULLDOG

Ask For No. 16

HAS THESE QUALITIES IN BOTH

HOLLOW AND SOLID

International High Speed Steel Co.
New York

You Can Drill

"Uppers"
"Breast Holes"
"Back Holes"
and
"Lifters"

Twice As Fast With A Jackson Hand Power Rock Drill

Man for man as you can with hammers. The "Jackson" is guaranteed against breakage for two years and to drill the hardest rock—even or seamy formation. The Jackson saves its cost every month. Over 2000 sold.

Awarded Gold Medal
Alaska-Yukon-Pacific Exposition

Write for our Catalog C-19.

It tells you all about our Drills and contains 10-year drilling records. We will give you name of our nearest agent where drill may be seen in operation.

The Mining Supply Co.,
68 Broad Street **New York, U. S. A.**

W. L. Imlay Rapid Cyanide Process Co.

Office: 723 Heed Bldg., **Demonstrating Works:** 139-141 West Oxford St., Philadelphia, Pa.

No tankage--continuous, automatic, economic. Minutes instead of days or weeks.

If you can't get your values, consult us. Send us an average sample of 100 or 200 pounds of your ore or tailings, direct to our mill (139-141 W. Oxford St.), freight prepaid.

We treat it by our process and inform you of the results. If a cyanide proposition, we will surprise you.

Mark it well so it will not be mixed with others.

The first plant is ordered by the Gold Ridge Mine of Alabama.

The second by the Mesa Rica Gold Mine, Sonora, Mexico.

Others are under consideration and will soon be closed.

Ores treated by our new Process:

Gold Ridge Mine, Alabama.		Recovery
Eckert vein, headings - -	$46.51	
Eckert vein, tailings - -	2.30	$44.21
Blue vein, headings - -	$34.09	
Blue vein, tailings (silver)	.20	$33.89
Black vein, headings - -	$49.00	
Black vein, tailings - -	2.51	$46.49
This is sulphide ore with coarse and free panning gold.		
Mesa Rica G.M. (Mexico) head'gs	$29.25	
Mesa Rica G.M. (Mexico) tailings	1.85	$27.40
Washington M. & M. (Cal.), headings (refractory) - -	$41.45	
Washington M. & M., tailings.	2.25	$39.20
Lucky Tiger (Mexico) headings (their tailings) (refractory)	$12.00	
Lucky Tiger, tailings - -	.90	$11.10
Lehigh ore, headings - -	$ 4.45	
Lehigh ore, tailings - - -	1.37	$ 3.08
Oregon ore, headings (refractory) - - - - - - - -	$ 2.57	
Oregon ore, tailings - - -	.82	$ 1.75
Colorado ore, headings (refractory) - - - - - - - -	$ 1.80	
Colorado ore, tailings - -	trace	total
Georgia ore, headings - -	$ 6.10	
Georgia ore, tailings - - -	trace	total
Reliance M. & M. Co., headings	$16.00	
Reliance M. & M. Co., tailings	trace	total
North Carolina ore, headings	$ 2.16	
North Carolina ore, tailings -	trace	total

Send for booklet and information.

Pneumelectric TRADE MARK.

Repeat Orders Tell The Story

In less than two years a SINGLE company has

Purchased 153

PNEUMELECTRIC COAL PUNCHERS

See How Fast The Orders Came:

Date of Order		Kind of Motor	No. of Machines
1907.			
Nov. 25	For trial with	D.C.	1
1908.			
Jan. 25	Machines with	D.C.	14
June 14	" "	D.C.	5
Nov. 18	" "	A.C.	1
Nov. 19	" "	D.C.	1
1909.			
Mar. 9	Machines with	D.C.	4
Mar. 31	" "	A.C.	1
Apr. 12	" "	A.C.	25
June 17	" "	A.C.	4
July 10	" "	D.C.	4
Aug. 30	" "	A.C.	25
Aug. 30	" "	D.C.	6
Nov. 1	" "	A.C.	50
Nov. 1	" "	D.C.	12
First Year 22			
Second Year 131	Total...		153

Write us for the name of this company and the reasons why the Pneumelectric is being preferred to all other mining machines.

The PNEUMELECTRIC Machine Company

Syracuse, New York

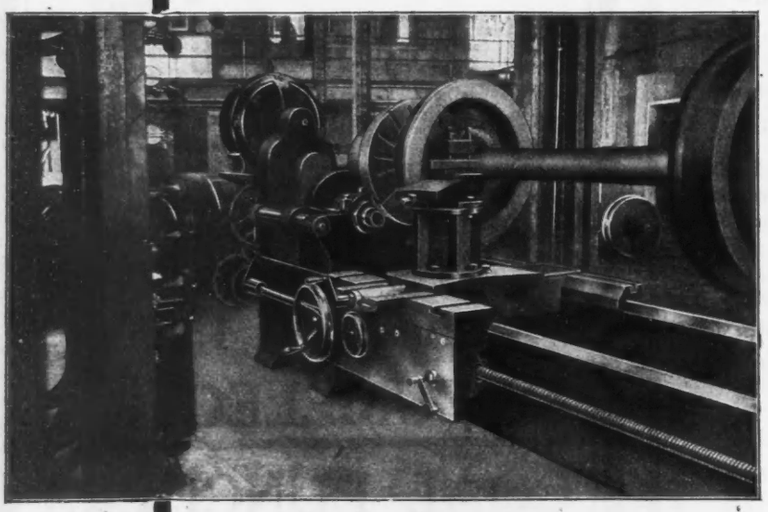
Pittsburgh, Pa., Keenan Bldg.
Charleston, W. Va., 903 Kanawha St.
Madisonville, Ky., Madisonville Savings Bank
Denver, Colo., 1710 Glenarm Street
Montreal, Can., 317 Craig Street, West
Calgary, Alberta, Can., 220 Ninth Ave., W.
St. Petersburg, Russia, Fontanka 52

(11-46)

To a Greater Extent Than Ever—

is it recognized that in no other lathe on the 1910 market can you get so much Lathe for the money as in McCabe's Patented "2-in-1" DOUBLE-SPINDLE LATHE.

We generally pay for every advantage we possess. Not so with McCabe's Lathe. You pay nothing for the extra 26-inch Lathe you get. And pay less for the 48-inch Lathe than any other 48-inch Lathe you could get.



McCabe's "New Style" **2-in-1**
Double Spindle Lathe
26 and 48 inch Swing

We'll leave it to your judgment as to whether you can buy anything for the price, in real merit?

That McCabe's "2-in-1" Lathes have come into their own long ago is proven by their supreme showing in the best shops in the country. McCabe's Lathe goes to Mine Repair shops where regular big Lathes can't—because they couldn't do the work.

J. J. McCabe

"The Double-Spindle Lathe Man"

30 Church St., New York City

Foreign Agents: Manning, Maxwell & Moore
Yokohama, Japan.

TRADE TISCO MARK

Turn over the solution of your wear problems to us and minimize expense and work.

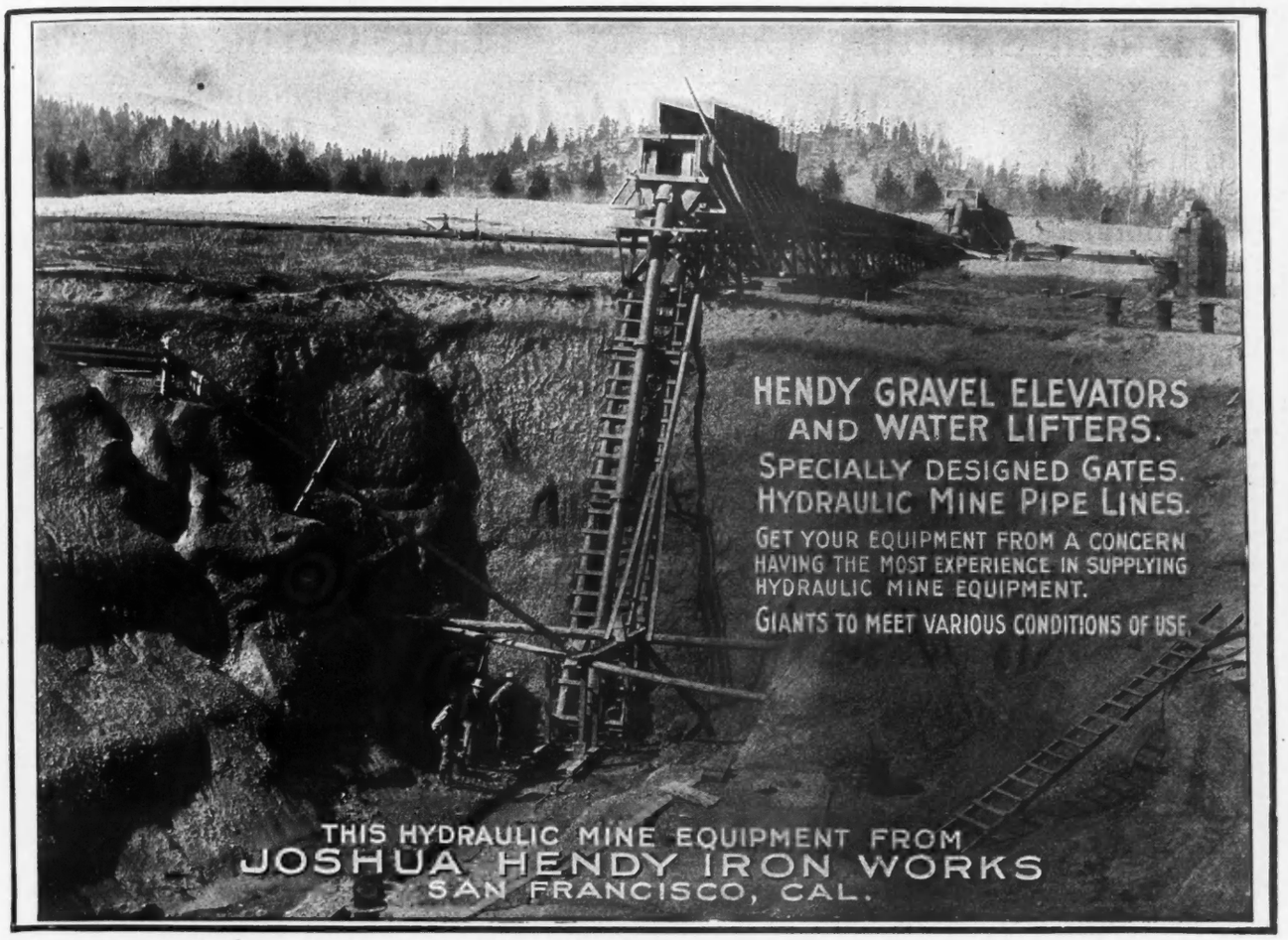
An organization of experts in the field of wear and breakage that can cope with situations with success.

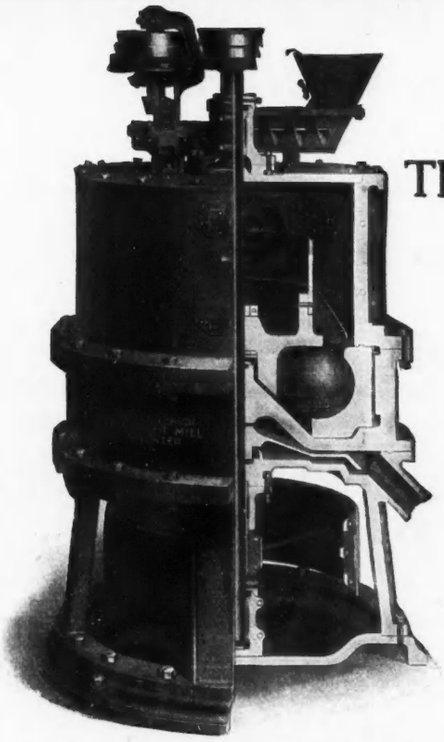
Experience and study together with the proper application of each particular steel places us in a position to reduce repair accounts.

Do you care?

TAYLOR IRON & STEEL CO., High Bridge, New Jersey.

TRADE TISCO MARK


HENDY GRAVEL ELEVATORS
AND WATER LIFTERS.
SPECIALLY DESIGNED GATES.
HYDRAULIC MINE PIPE LINES.
GET YOUR EQUIPMENT FROM A CONCERN
HAVING THE MOST EXPERIENCE IN SUPPLYING
HYDRAULIC MINE EQUIPMENT.
GIANTS TO MEET VARIOUS CONDITIONS OF USE.
THIS HYDRAULIC MINE EQUIPMENT FROM
JOSHUA HENDY IRON WORKS
SAN FRANCISCO, CAL.



Extract All The Values

BY USING

THE FULLER-LEHIGH MINING MILL

for pulverizing your ore. The finished product delivered by this machine contains the highest percentage of mineral available for extraction, and makes extraction of all the values possible.

GRINDS EITHER WET OR DRY
TO
ANY DESIRED FINENESS

from 60 to 150 mesh. In one operation and without subsequent screening, it takes $\frac{3}{4}$" material direct from crushers and delivers 4 to 6 tons per hour with a consumption of less than 65 H.P.

Particulars on request.

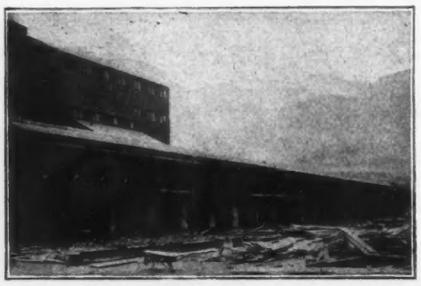
LEHIGH CAR, WHEEL & AXLE WORKS
MAIN OFFICE, CATASAQUA, PA.

NEW YORK, N. Y.
Fulton Bldg., 50 Church St.

HAMBURG, GERMANY
Alsterdamm 7.

KANSAS CITY, MO.
Scarritt Bldg.

Garfield Smelting Company's Plant, Garfield, Utah

8,000 Tons  **Steel Buildings**

Flue Supports.

We are Engineers and General Contractors for Steel Mill and Mine Buildings.

Branch Offices:
Salt Lake City, 324 Dooly Block
Denver, 313 Mining Bldg.
El Paso, 313 E. P. & S. W. Bldg.
Seattle, 338 Globe Bldg.
Butte, 352 Phoenix Bldg.

Minneapolis Steel and Machinery Company -:- Minneapolis, Minn.

For Dry or Wet Crushing:

TRADE MARK **ADAMANTINE**

Rolled Chrome Steel

Shells and Rings

Forged, Punched and Rolled from a Solid Chrome Steel Ingot

CHROME STEEL WORKS
CHROME. N.J..U.S.A.
(FORMERLY OF BROOKLYN, N.Y.)

Best Material for:

Shells for Cornish Rolls
Rings and Tires for Chilian Mills
Ring Dies and Rollers for Huntington Mills
Rings and Tires for Griffin Mills, etc., etc.

Send for illustrated pamphlet "Rolled Shells and Rings"

Represented by: J. F. Spellman, 202 Century Bldg., Denver, Col. G. W. Myers, 724 Kohl Bldg., San Francisco, Cal.

Mashek Engineering Company

Briquetting Machinery

We have built and equipped more Coal Briquetting Plants than all other Manufacturers combined, and all are a Commercial Success.

Crushing Plants

Complete plants for quartz or stone, designed and erected.

Mining Machinery

Let us figure on your complete installation. We take contracts for complete plants turned over to owners in operation and guaranteed.

Cement Plants

Contracts taken for complete mills.

90 West Street (West Street Bldg.) New York

Pat. August 13, 1907.

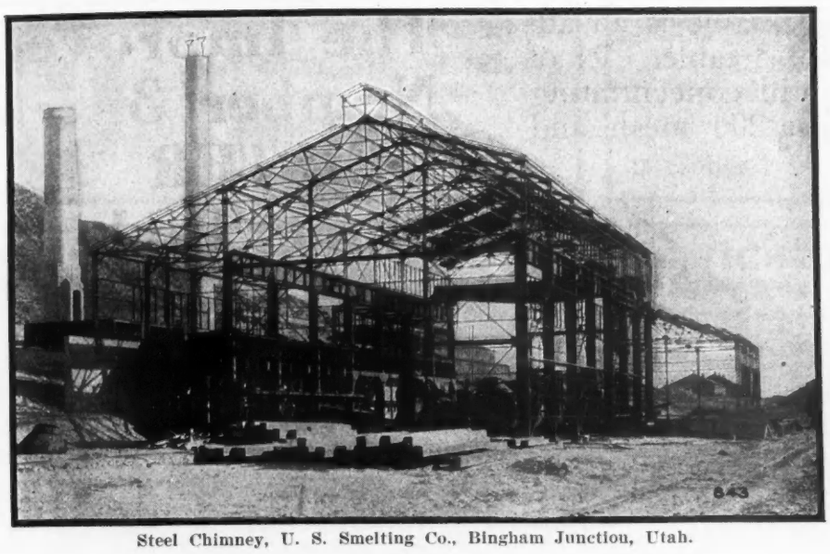
The Big Difference Is In Power Saved

The Multiple Tube Mill requires only one-half as much power as the old type of tube mill. And the reason is because it has its load distributed equally around the centre about which it revolves when in operation.

It's the most economical device for pulverizing any material which is not sticky.

Write for Particulars.

J. R. Alsing Engineering Company
134 Liberty Street, New York, U. S. A.



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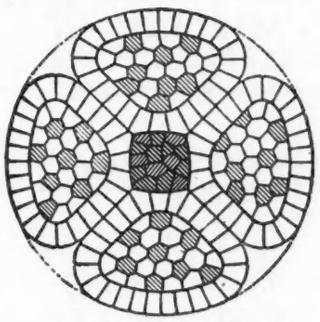

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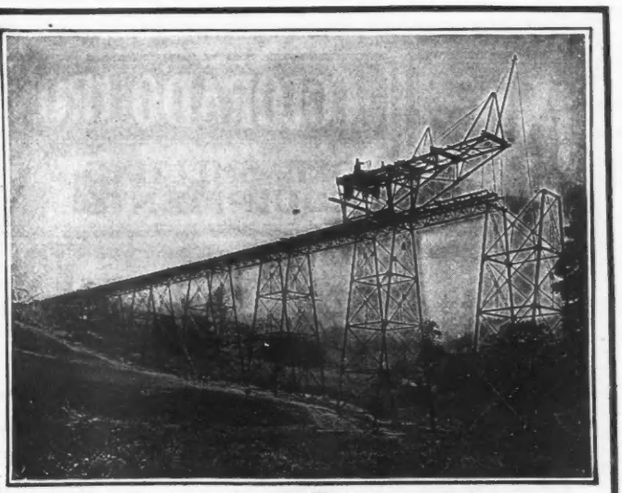

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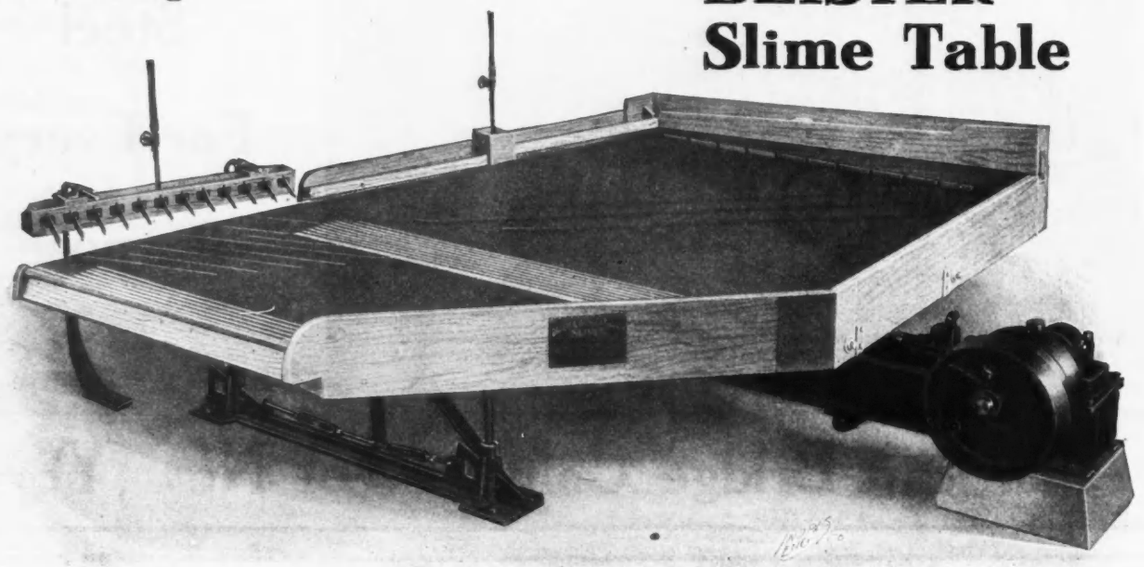

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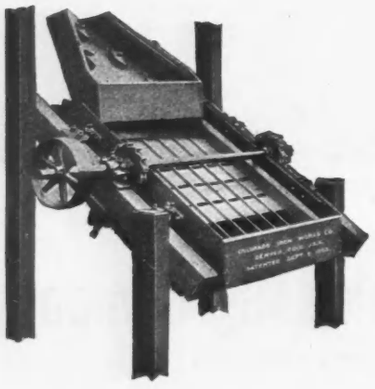

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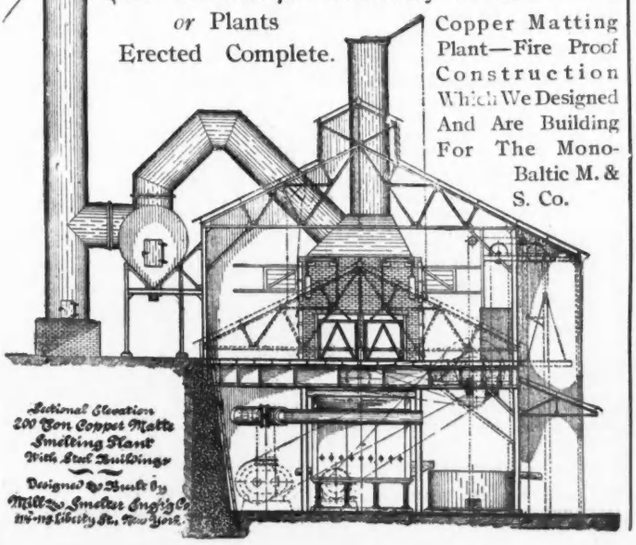

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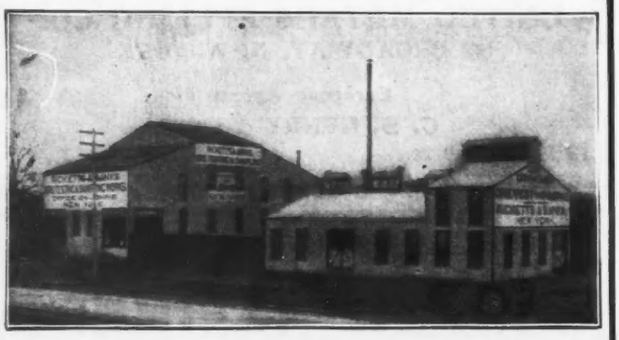

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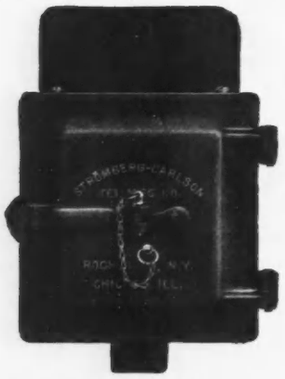

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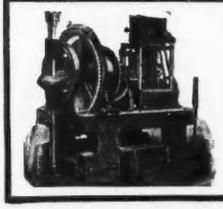

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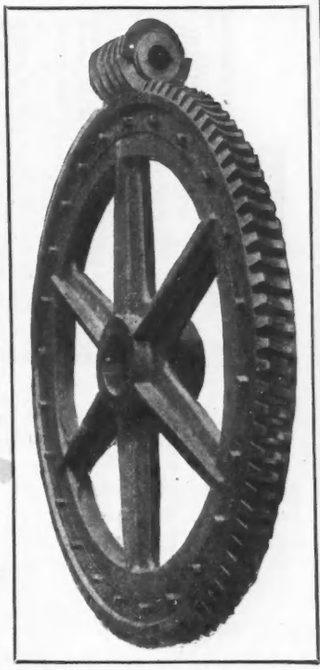

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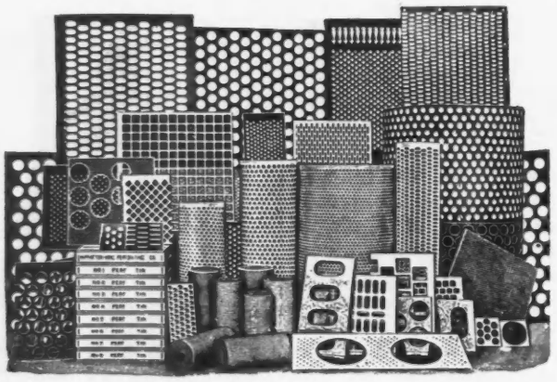

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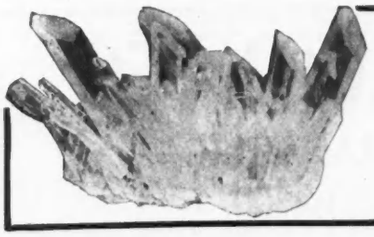

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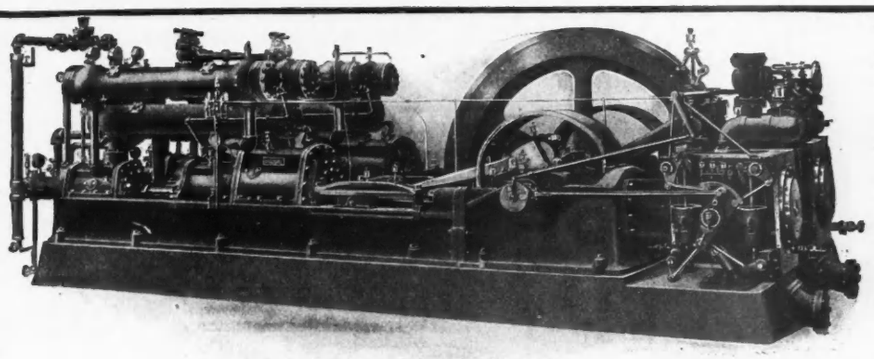

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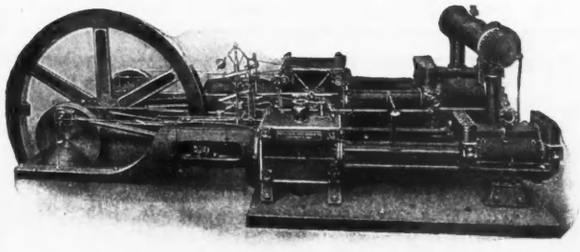

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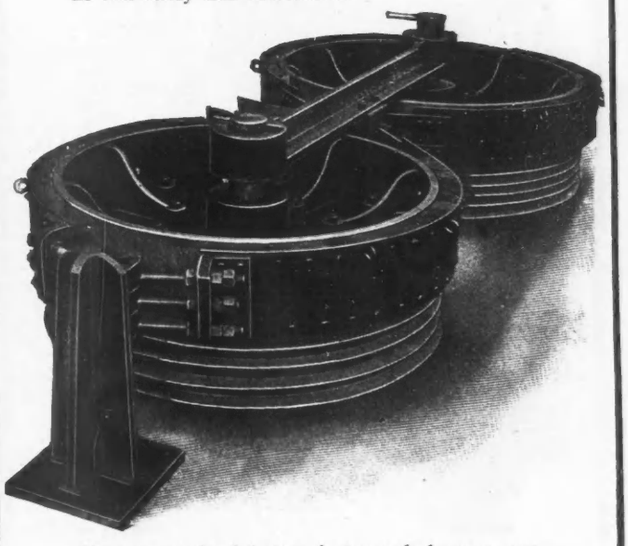

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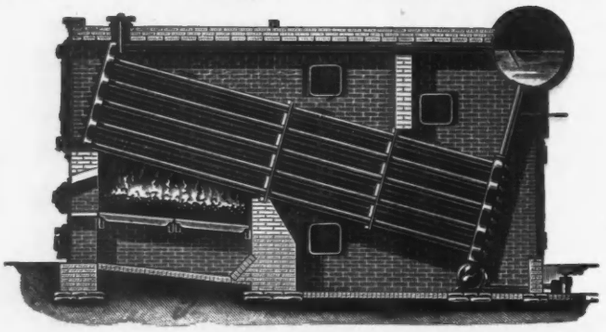

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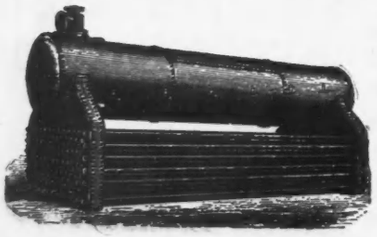

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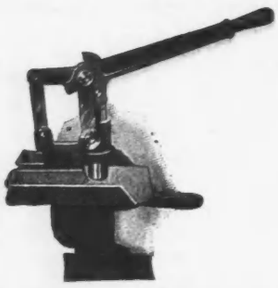

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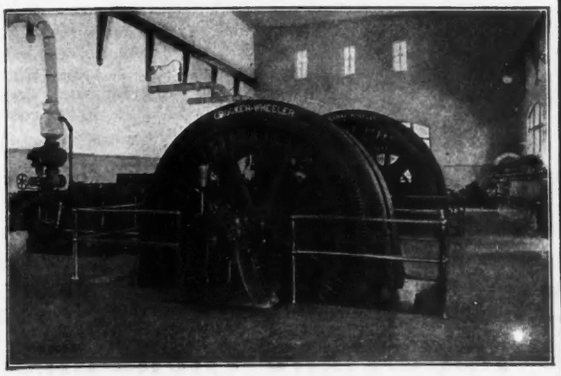

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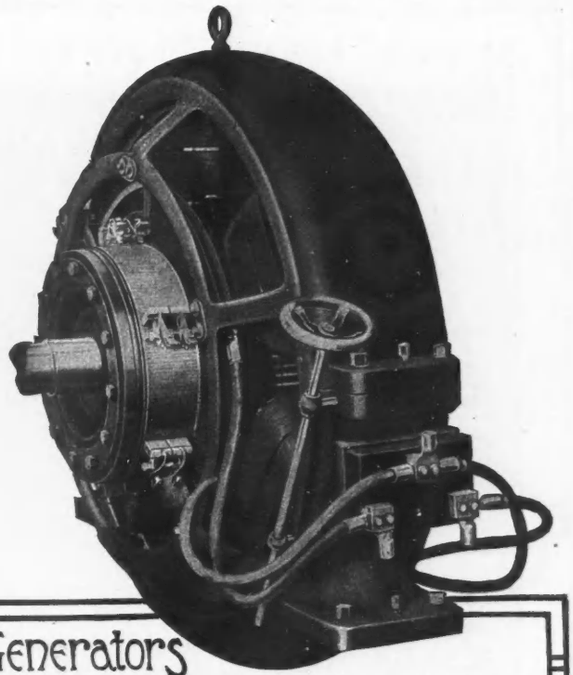

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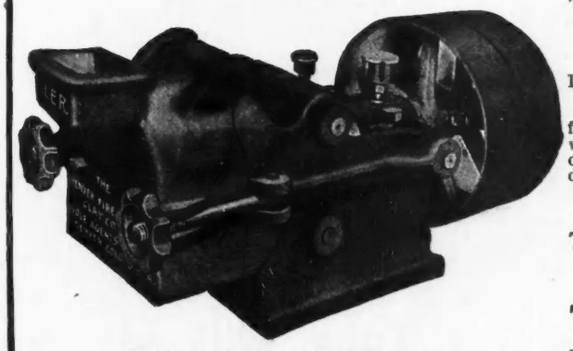

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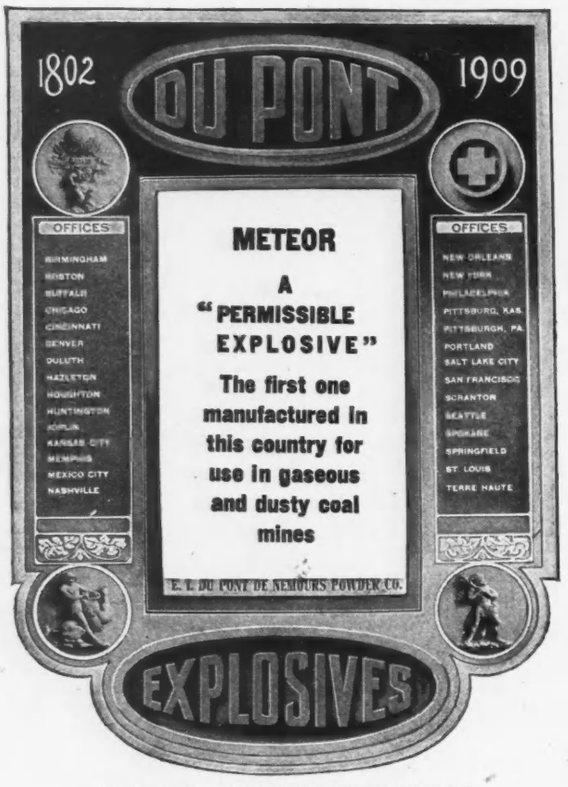

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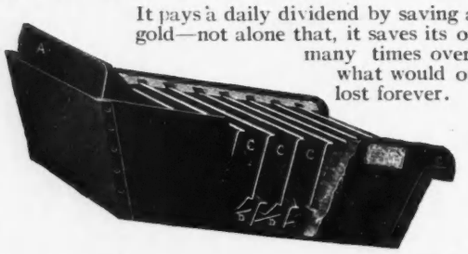

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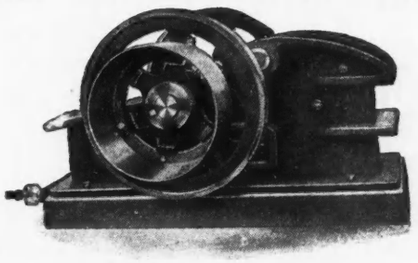

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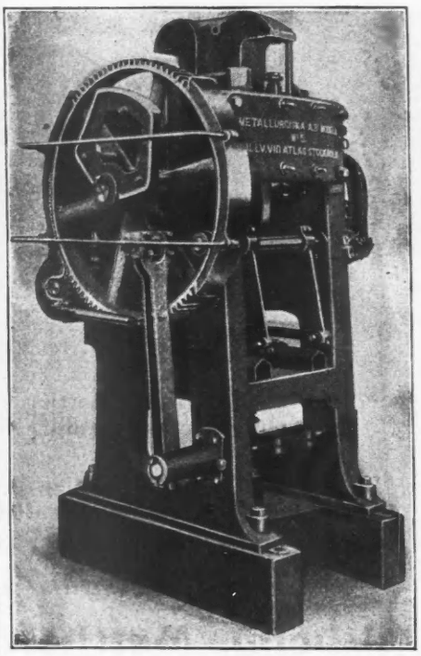

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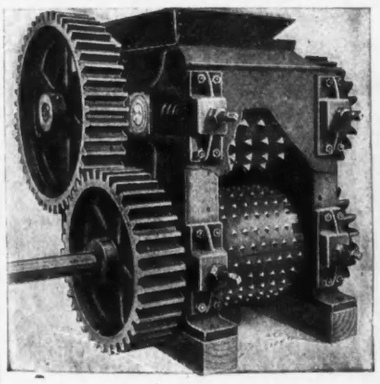

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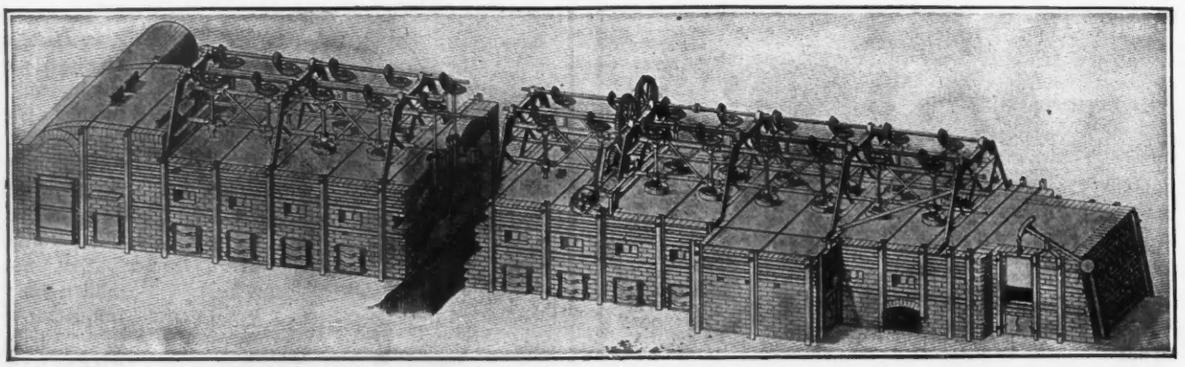

The Edwards Patent Mechanical Ore Roasting Furnace uses no fuel whatever but that to be found in the ore where sulphur obtains in any quantity and less fuel than any other furnaces where there is any sulphur at all.

The "Edwards" has a record for extracting 98% of all the gold in the ore. The mechanism is very simple and requires practically no attention after starting.

It will bear the closest investigation because THERE IS NO OTHER JUST AS GOOD.

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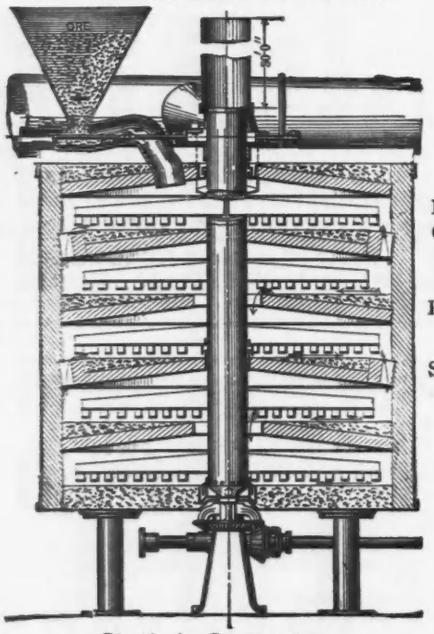
The Herreshoff Roasting Furnace
FOR DESULPHURIZING ORES

Repairs and Labor Cost Nominal.

One man can attend 100



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No Shutting Down

Simple in Construction

No Fuel Used **Over 750 In Use**

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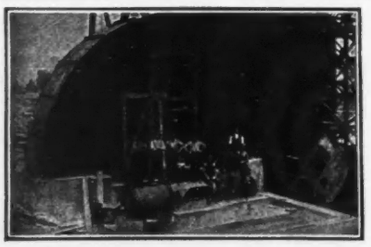

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of tire steel. The same method is followed as in the manufacture of steel locomotive tires, thereby assuring solid, weldless material to correct sizes, and of unsurpassed quality.

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We show here one of many types of our "Samson" Hoists.

Whether Steam or Electric, "Samson" Mine Hoists represent strictly up-to-date machines, designed and built throughout for severe service.

Cut Gears, Steel Pinions and Rawhide Motor Pinions are standard with us, not special.

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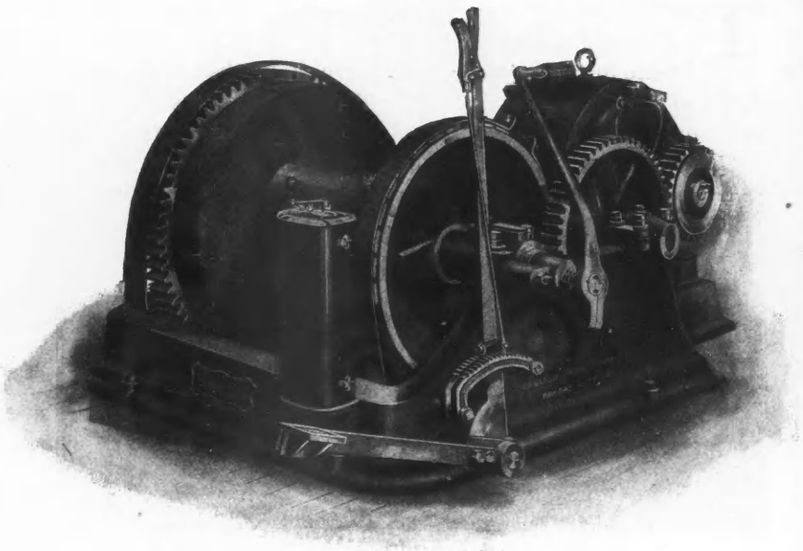

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NON-CORROSIVE AND STRONGER THAN STEEL

SPECIALLY ADAPTED FOR ROOFS, SKY-LIGHTS, VENTILATORS, ETC., OF SHOPS, SMELTERS, GAS-HOUSES, ROUND-HOUSES, RAILROAD DEPOTS, AND ANY PLACE WHERE A NON-CORROSIVE METAL IS OF PARAMOUNT IMPORTANCE.

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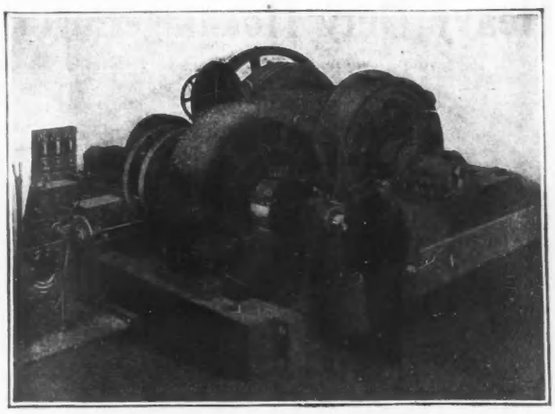

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Our Line of Motors and Controllers for Driving Hoists

is complete. Whether intended for direct or alternating current service, and no matter what the conditions to be met, we have just the right motor and just the right controller to operate it. Don't bother about your hoisting problems, let our engineer solve them for you.

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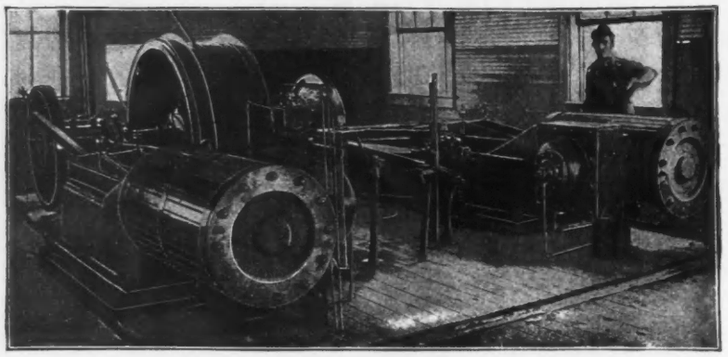
THE "Danville" is no "hastily-assembled" hoist. Every part of the Danville is an evidence of what over 30 years' experience has done in the way of producing a hoist that is as perfect as human skill and ingenuity can make it. The World's Hoisting Records are held by Danville Hoists—**3,516 Tons of Coal in 8 Hours Is One of Them.** Write for full details and the address of the nearest Danville to you.



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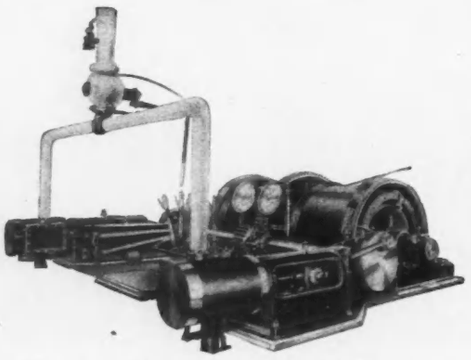
HOISTING ENGINES

Heavy Duty Hoisting Engines



This is one of our heavy duty double drum hoisting engines of the extended frame type. The engine frames are extended in front of the drums, bringing the pinion shaft in front of the hoist instead of in the rear as in the self-contained type of hoist. This brings all moving parts of the engine into full view, where they can be properly inspected and easily maintained.

The frames and all parts are of extra heavy design. Gears and pinions are provided.

We build these hoists with five, six, seven or eight foot single or double drums.

Full particulars and prices when you write.

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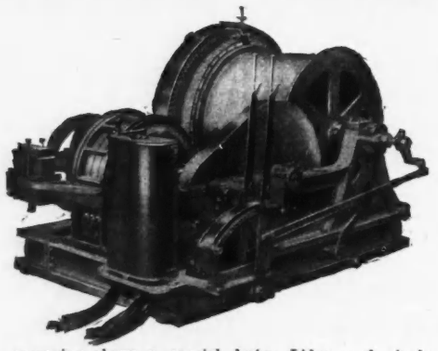
LIDGERWOOD MINE HOISTS
STEAM AND ELECTRIC



The engraving shows a special design Lidgerwood single friction drum Alternating Current Induction Motor Mine Hoist equipped with Solenoid Brake.

It is furnished in sizes from 15 H. P. to 150 H. P. with a hoisting capacity of 1500 lbs. at a speed of 250 ft. per minute to 6500 lbs. at 575 ft. per minute.

The Solenoid Brake is applied to the armature shaft and operates automatically when the current is cut off either by accident or when the hoist is stopped.

All Lidgerwood hoisting engines are built on the duplicate part system and are entirely self-contained.

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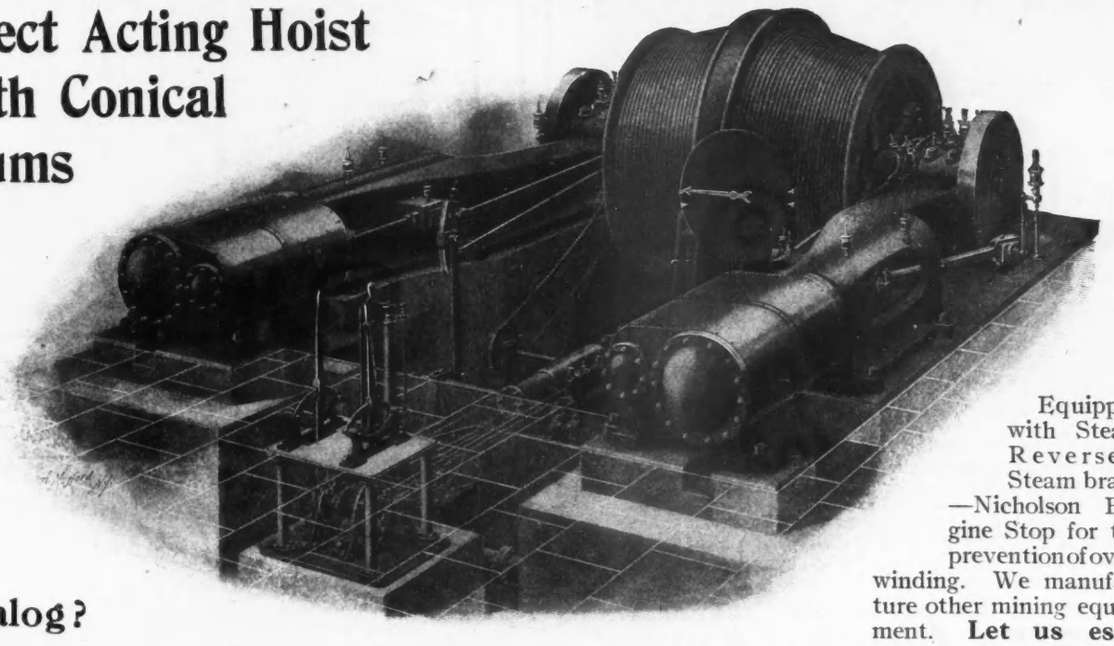
Direct Acting Hoist With Conical Drums



Equipped with Steam Reverse—Steam brake—Nicholson Engine Stop for the prevention of overwinding. We manufacture other mining equipment. **Let us estimate on your needs.**

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When you hear an Ottumwa Steam or Electric Hoist spoken of you may know that its owner is getting the utmost service and the maximum amount of work out of it at the least cost. Ottumwa Hoists are built by experts for long, hard service and to successfully meet the severest strains that a hoist is called upon to bear.

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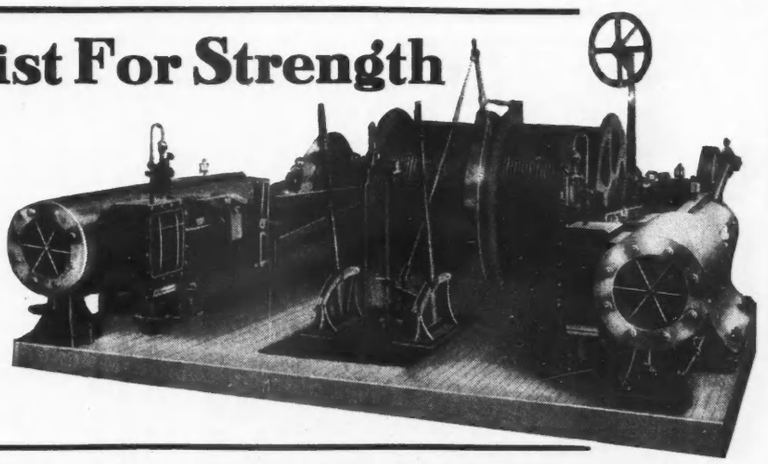

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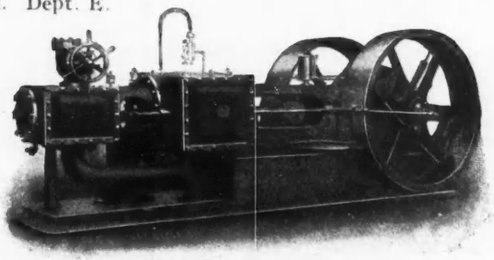
Let Us Show you why Ridgway Dynamos and Engines are the best built for mining purposes. Write for details. It will *pay* to have them. Dept. E.



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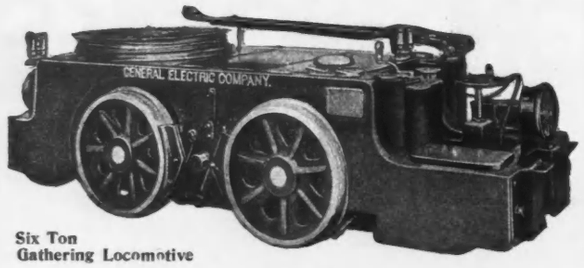

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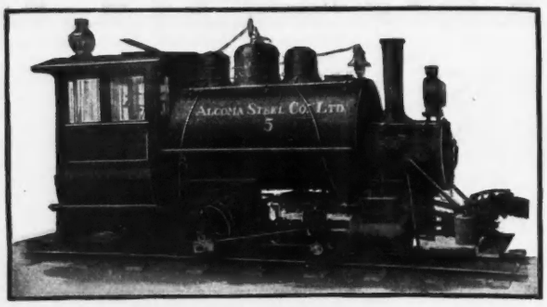

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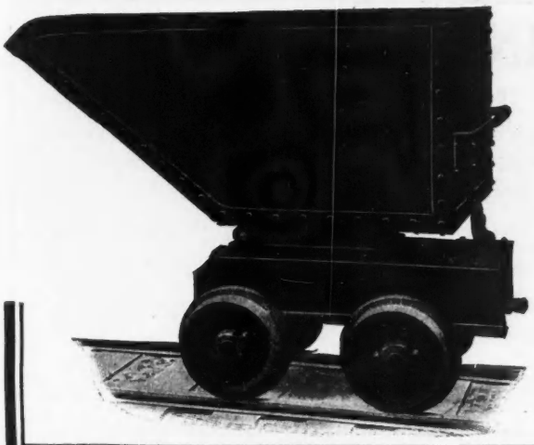

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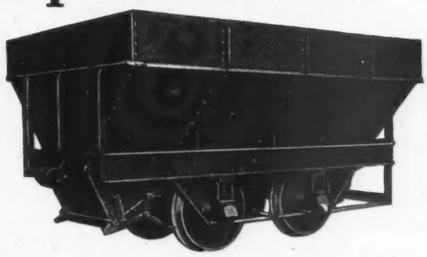

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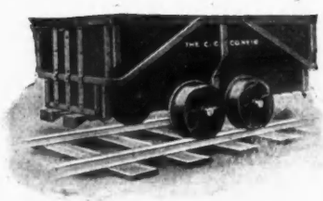

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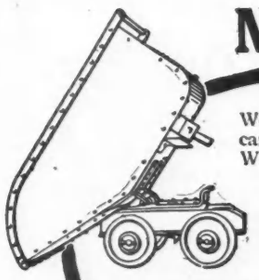

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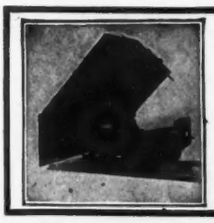

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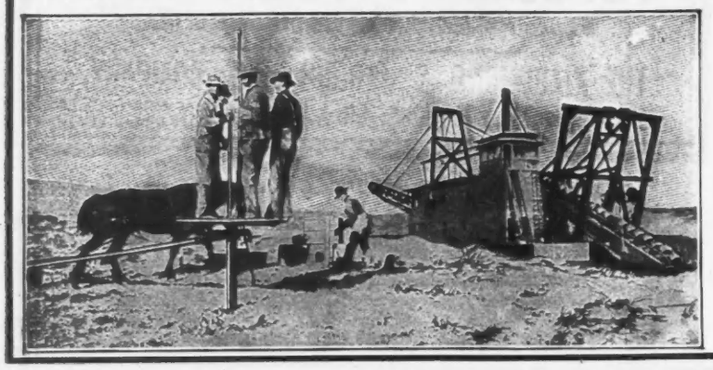

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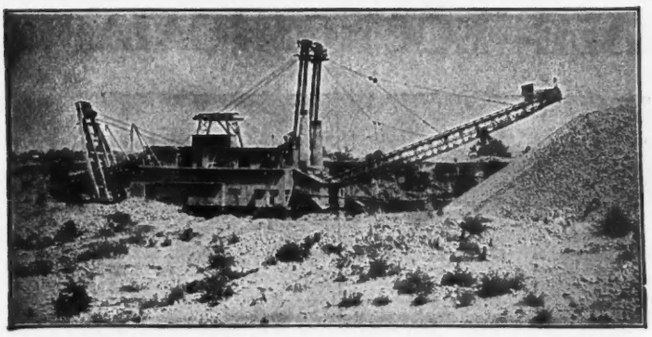

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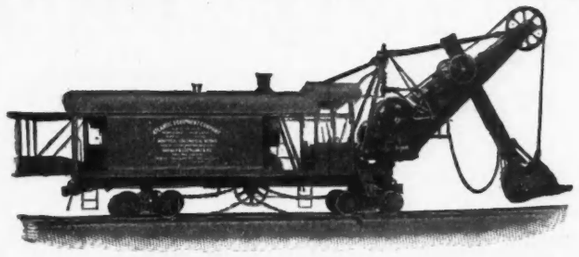

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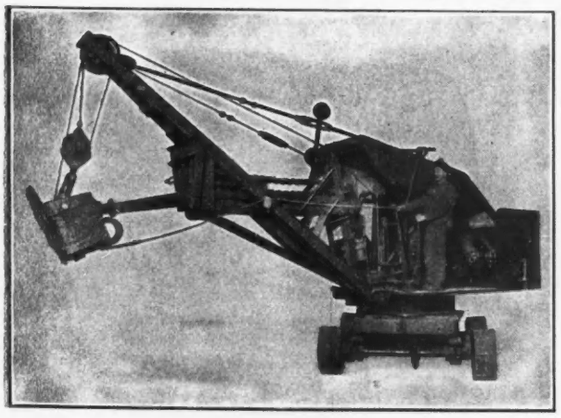

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The real cost of lubrication is the price of the lubricants themselves *plus* the cost of friction accompanying their use. To cut this cost down, it is only necessary to use Dixon's Flake Graphite. It will solve the problem quickly by getting closest to the cause of friction.

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VITRIBESTOS is the only absolutely fire and water-proof insulation for lining smoke stacks that is also proof against acid fumes and gases of combustion. Sulphurous or other gases of combustion, fire or water have no effect whatever on it.

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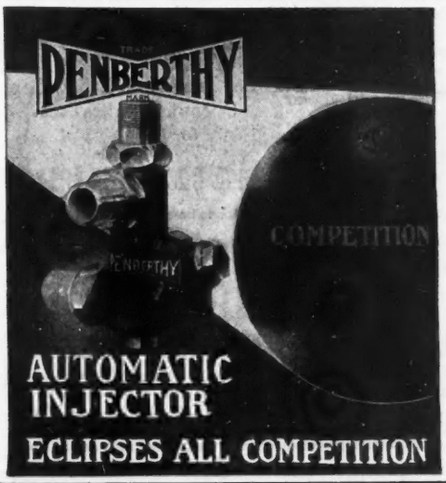

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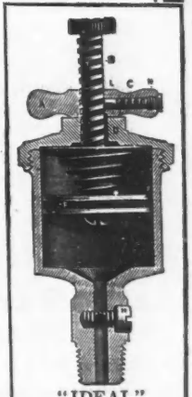

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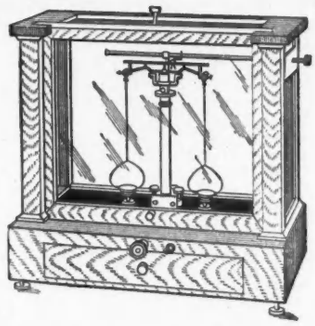

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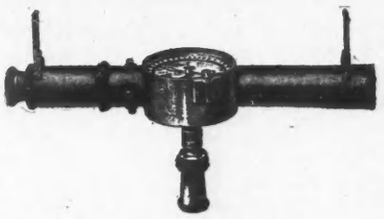

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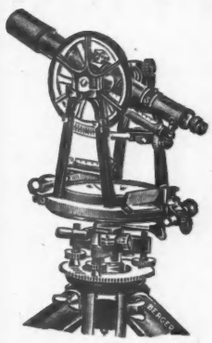

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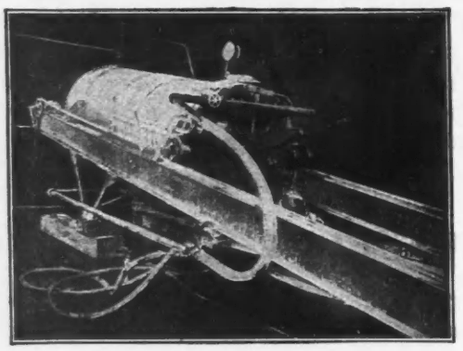

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One man can take care of several units.
It saves in water and values.
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Jobbers of New and Second-Hand Machinery

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1 10x10x10 Union Compressor.
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We also carry a large stock of all sizes of black and galvanized pipe, all sizes of mine rail, together with a full stock of fittings and supplies.

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Several secondhand electrically driven bucket hoists with 22 or 37 HP induction motor drive for operation with 1200 and 1500 pound capacity buckets and operating at a speed of about 600 feet per minute. Drum should have a cable capacity of about 250 feet. When replying, state make of motor, price asked, and time hoist has been used.

When replying address

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Promoters Wanted.

Promoters and MINE OPERATORS wishing to develop the big Lead and Zinc deposits which we own in Ottawa County, Oklahoma, can secure liberal terms from us. There is an excellent demand for Lead and Zinc ores, and, therefore, an excellent opportunity is offered to interest people in Lead and Zinc Mining. Our District is of exceptional value and our terms very profitable to promoters and operators. Address

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New Graving Dock For Talcahuano

The Chilian Naval Commission invites Tenders for the Construction of a New Graving Dock and Tidal Basin at Talcahuano Dockyard.

Firms desiring to submit Tenders may obtain specifications, Instructions for Tender, drawings and other particulars, on application after the 26th. inst. between three and four p. m. at the Office of the Chilian Naval Commission, upon payment to the Fiscal Treasury of Chile, 121 Victoria Street, S. W. of the sum of ten dollars.

The above mentioned amount will be returned to the Tenderer, provided he shall have sent a bona fide Tender and not have withdrawn the same, but in no case will the fee be returned unless a bona fide Tender is submitted. Full particulars of the work may be obtained on application at this office before the payment of the fee for the specification, etc.

The Engineer's estimate for this work is £954,060.

Tenders to be presented at the Ministry of Marine, Santiago, Chile, and will be opened in the presence of the interested parties on the 1st day of March, 1910, at two p. m.

RICARDO SANCHEZ, Consul General of Chile.

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POSITIONS VACANT

Advertisements under this heading 50 cents for 50 words or less. Additional words, two cents a word. Cash or stamps must accompany order.

Wanted for mine in Mexico, accountant with thorough knowledge of Mexican mining and stamp laws, storekeeping, timekeeping and general mine accounts, including costs system; salary $300 Mexican currency per month; answer with references, "Granite," ENGINEERING AND MINING JOURNAL. January 15.

Wanted—Master mechanic to take complete charge of mechanical and electrical equipment of mine in state of development in Mexico; must have working knowledge of Spanish; salary $175 United States currency per month. Answer giving references, "Graphite," ENGINEERING AND MINING JOURNAL. January 15.

Bookkeeper wanted for smelter and mines, copper; must have filled satisfactorily such a position and sufficiently experienced to organize and handle such accounts; state lowest salary, experience and references; healthy location. Address I. W. Von Leer, Johnson, Arizona. December 25.

Sales engineer by a concern manufacturing high grade steel exclusively in castings and forgings; field extension work and attending long established business lines; position requires the initiative of an energetic, able, educated man of experience; excellent opening for right man; only those who give nationality, age, education, experience, references, and salary expected will be considered. Address "A. 25," ENGINEERING AND MINING JOURNAL. t.f.

Wanted for mine in Mexico, young engineer with experience in surface and mining geology; salary $150 gold and expenses; must be a technical graduate. Answer giving previous experience to "Dasite," ENGINEERING AND MINING JOURNAL. January 15.

Wanted for mine in Mexico topographical draftsman familiar with use of plane table; man who has had experience on United States or coast surveys preferred; salary $150 gold per month and expenses. Answer, "Dasite," ENGINEERING AND MINING JOURNAL. Jan. 15.

Wanted—By a large concern, an engineer, technical graduate, for operating an experimental mill treating galena, pyrite, blende ores and later a larger mill for regular reduction operation; graded wet crushing and concentrating and electro-static equipment; must be thoroughly experienced in well regulated mill operations and be qualified to conduct careful testing work for definite results; electrostatic separation experience not necessary; location in the southwest; reply giving full particulars of experience, salary expected, etc. Address "Concentrator," care of ENGINEERING AND MINING JOURNAL. January 1.

Wanted—Draftsman for mine maps and general colliery work, including mechanical drawings; state experience in full and least salary considered. Address "X. Y. Z.," care ENGINEERING AND MINING JOURNAL. February 26.

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Advertisements under this heading 50 cents for 50 words or less. Additional words, two cents a word. Cash or stamps must accompany order.

Successful superintendent of a large Western mine which closed down is seeking engagement as manager, superintendent or examining engineer. Educated at Michigan University and Colorado School of Mines. Best experience gained at De Lamar and Cœur d'Alenes, Idaho, Butte, Nevada and Colorado. Excellent references, including last general manager. Address T. Worth Bowen. Residence, Y. M. C. A., Salt Lake City. No. 659, T.F.

Technical graduate, with ten years' successful experience, desires engagement as manager, superintendent or engineer; especially proficient in cyanidation of gold and silver ores, but intimate with every detail from breaking of ore to melting of bullion; live, economical, efficient; speaks Spanish; good Mexican experience. Address "Engineer," Box 1531, Denver, Colo. January 8.

Wanted—Position as general or business manager of gold or silver mining or mining and milling company of established financial standing, by reliable, honest, married man of forty; long experience; speaks and writes Spanish; open for engagement in any country; prefer Mexico. Address C. Q., General Delivery, Stroudsburg, Penn. December 25.

Mining engineer, fifteen years' experience in opening up mines and in mine and railroad construction work, desires position; good business ability and can do all necessary technical work on small operation, such as assaying, drafting and surveying; willing to accept moderate compensation until ability is demonstrated; references. Address P. O. Box 148, Omaha, Neb. January 15.

A superintendent of twenty years' experience, a specialist in gold-silver mining and metallurgy, is open for engagement. Address Box 773, care ENGINEERING AND MINING JOURNAL. January 8.

Mining engineer, with good technical education and practical experience in the United States and Mexico. Speaks Spanish fluently, and can furnish the best of references. Desires position with development o pospecting company, or as superintendent of a young property with a future. Box 771, care ENGINEERING AND MINING JOURNAL. January 8.

Accountant and auditor (mining), with A-1 experience in handling offices and accounts is open for engagement; organization, systems, audits, reports and other details requisite to up-to-date efficiency thoroughly understood; testimonials and references strictly high-class; traveling or foreign position acceptable. Address Box 762, ENGINEERING AND MINING JOURNAL. April 9.

Mining engineer, at present manager of large property, desires to change for good reason. Experienced in all grades of mine work and management and if anything in the property can get it out. Age 36; graduate Michigan College of Mines. Present place worth $4,000 and expenses. Would accept less with company which has a future. L. L., ENGINEERING AND MINING JOURNAL. No. 664, T.F.

American, mining engineer, nine years' varied experience in various parts of Mexico, desires engagement as superintendent or assistant superintendent of gold-silver mines. Technical graduate, understands handling native labor and difficult transportation; speaks, reads and writes Spanish. Can leave immediately for mines if conditions are satisfactory. References furnished. Address "Durango," care ENGINEERING AND MINING JOURNAL. No. 708, Dec. 25.

Chemical engineer, thorough experience, electrical, chemical, mechanical; design, erection and superintendence, desires change; at present superintendent chemical works; age 37, married; graduate in chemistry; seventeen years' experience. Address Box 764, ENGINEERING AND MINING JOURNAL. December 25.

Graduate mining engineer of ten years' successful experience in mining, transportation and concentration of low grade ores, will undertake the design, arrangement and installation of complete new plants or the enlargement and improvement of present one; specialty, modern all steel concentration and smelting plants. Address Box 784, ENGINEERING AND MINING JOURNAL.

Graduate engineer, nine years' experience in management of large low grade properties will be open for engagement about March 1; specialty, mining and concentration of copper and lead; Spanish spoken; salary $4000 upward, according to responsibilities involved. Address Box 783, ENGINEERING AND MINING JOURNAL.

Expert mine and smelter accountant will open, close and audit books; systematize accounts and costs; prepare cost sheets, metallurgical statements, etc.; examinations, reports and advice; United States and Mexico experience; highest references. Address Box 737, ENGINEERING AND MINING JOURNAL. January 1.

Graduate mining engineer with twenty years' varied and thoroughly practical experience in the United States, Canada, South Africa and Mexico is open to engagement as superintendent, manager or examining engineer. Up in the latest practice in mining, milling and mechanical equipment. Successful in handling labor and general business management of affairs at the property. Speak Spanish. Address Box 781, ENGINEERING AND MINING JOURNAL. Jan. 8.

Mining engineer, technical graduate, ten years' experience, topographic, mine and railroad surveys, mine development, coal and coke plant construction and operation; capable of handling mine proposition from virgin conditions to operation; southwest preferred; can furnish service letters from past and present employers; present work suspended. Address Box 782, ENGINEERING AND MINING JOURNAL. December 25.

Stop, look, listen; graduate chemist and assayer, with several years' experience in copper, lead and zinc smelters, desires position with responsible mining or smelting company; permanent position only accepted; initial salary of no consequence; exceptional references; will go anywhere and at once. Address Box 779, ENGINEERING AND MINING JOURNAL. January 15.

Mining and metallurgical engineer, American, technical graduate, experience in the United States and Mexico, seeks engagement as manager or superintendent of mine preferably one about to install reduction works; examinations and plans made for that purpose; first class references. Address Box 777, ENGINEERING AND MINING JOURNAL. January 15.

Metallurgist, with ten years' experience in copper smelting and concentration desires position as superintendent or assistant superintendent with substantial company; technical graduate, Mexican experience; A-1 references; no answer desired from companies mining in the stock market. Address Box 778, ENGINEERING AND MINING JOURNAL. January 15.

A Columbia School of Mines graduate, age 27, unmarried, with six years' experience in West Canada, Mexico, Central and South America, speaking Spanish, desires engagement as engineer or assistant superintendent. Address Box 776, ENGINEERING AND MINING JOURNAL. January 1.

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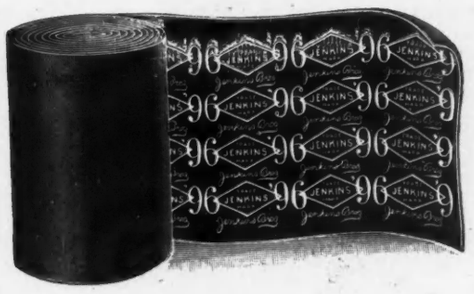

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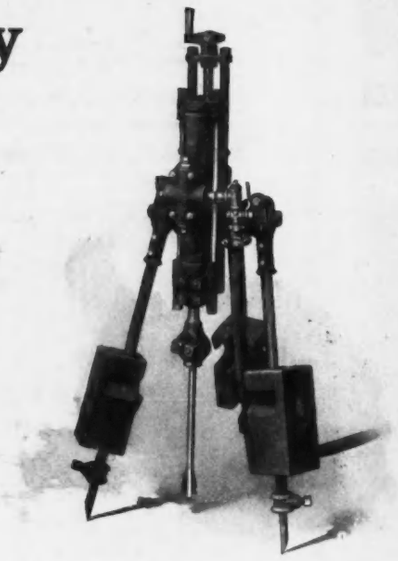

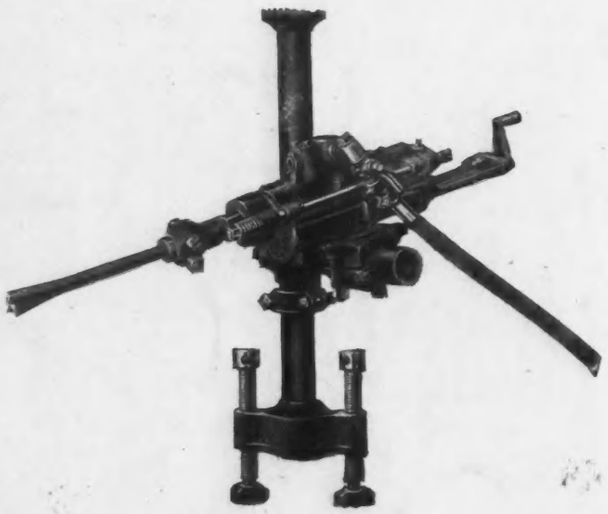

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